A Scranton Gillette Publication

JUNE 1958

WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL

WATER TANK MAINTENANCE ► may be improved by proper attention to inspecting periods, repainting schedules and cathodic protection.

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Solving Taste and Odor Problems p. 232

Algae Effects on D.O. and B.O.D. p. 235

The Uniflow Tank p. 249

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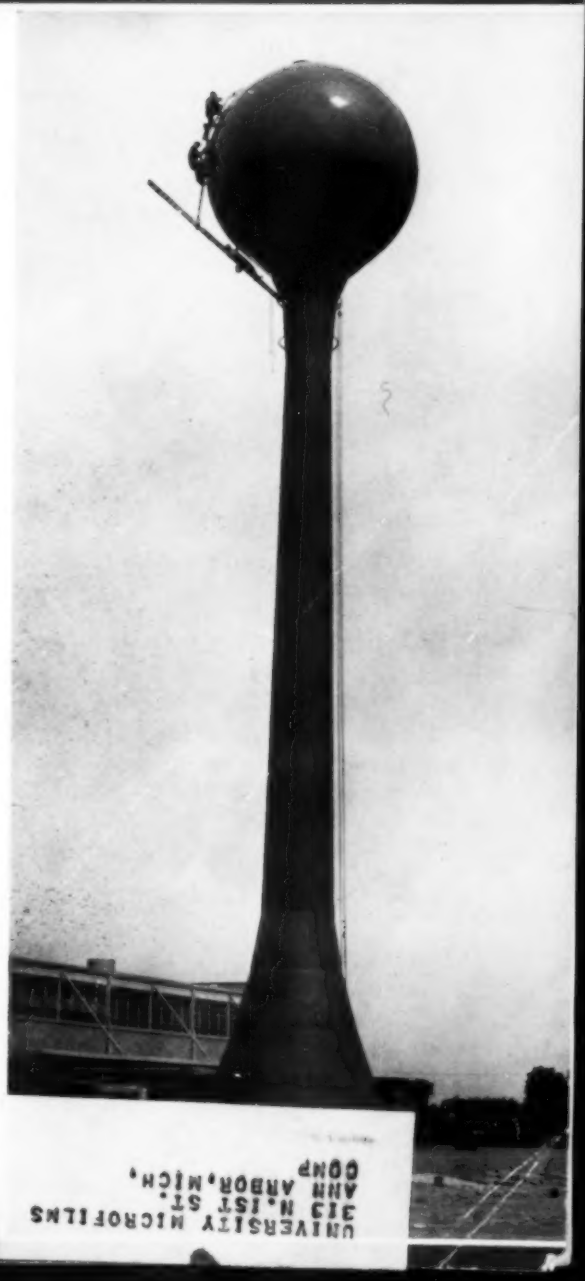

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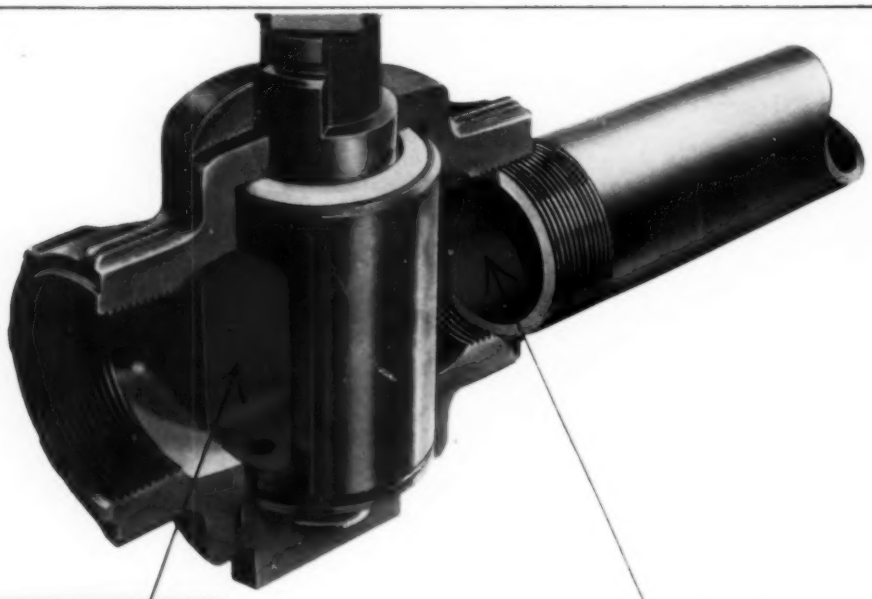

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*Du Pont's tetrafluoroethylene resin.

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DESPITE extremely wet trench conditions, installation of a new sanitary sewer system at Beach Haven, New Jersey, was completed in record time with Vitrified Clay Pipe. More than 29,000 feet of Clay Pipe in 6, 8, 18, and 21 inch diameters were installed, yet the standard Weir test showed an infiltration rate far below specified requirements.

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Contractors: Canning & Cestone, Maplewood, N.J.

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HOW TO SELECT WATER-CONDITIONING EQUIPMENT (NO. 7 OF A SERIES)

*Water Impurities and Methods of Treatment**

HARDNESS *(Scale)* Calcium or magnesium salts such as bicarbonates, chlorides and sulfates	**Ion Exchange** (zeolite softeners). Generally used on clean, clear water to reduce hardness to a very low figure. Also avoids repumping. **Precipitator** (cold lime-soda softening). Used where turbidity, color or iron or manganese are also to be removed. Sometimes used for softening only—gives lower operating cost than ion exchange on high-carbonate-hardness waters. Reduces hardness to a few grains per gallon. Can be followed by zeolite softeners. **Hot-process Softener** (lime-and-soda process) usually followed by anthracite filter. Used for boiler feedwater. Also removes silica. Reduces hardness to a few grains per gallon. If followed by a zeolite softener (optional), no soda ash is used.
TURBIDITY Suspended dirt, sand, silt or other solids	**Sand Filter** (gravity or pressure type) alone . . . for water with moderately low turbidity content. **Precipitator** will reduce bulk of turbidity; generally followed by sand or anthracite filter for practically complete removal.
COLOR Dissolved or finely divided organic matter	A **Precipitator** with alum coagulant is generally used. Powdered activated carbon is sometimes added for further reduction of color. **Chlorination** may be used to kill living organic matter.
BAD TASTE OR ODOR Hydrogen sulfide (H_2S), cause of "rotten egg" odor	**Aeration** with several hours detention. **Adding chlorine:** Expensive except for removing small residuals. **Forced-draft degasifier:** Used if there are 10 or more ppm of H_2S or if CO_2 is also to be removed. **Carbon Purifier** (Carbo Dur®) or **Manganese Zeolite Filter:** For small volumes of water with 2 ppm or less H_2S.
Algae, organic matter	Same treatment as for COLOR. A **Carbon Purifier** may be used for small volumes of water . . . preceded by a sand filter if turbidity or debris is to be removed.
Excess chlorine	A **Carbon Purifier** provides simple, automatic operation. Also removes other causes of tastes and odors. **Sodium Sulfite** treatment reduces chlorine at lower equipment cost.
CORROSIVENESS Low pH due to free mineral acids	Neutralize with caustic soda, soda ash or lime.
Low pH due to carbon dioxide (CO_2)	**Aeration** reduces CO_2. A **forced-draft degasifier** removes practically all CO_2. **Neutralizing Amines** are used for corrosive hot condensate. Feeding **sodium silicate** will coat inside of pipes.
Alkalinity (carbonates and bicarbonates that form CO_2 under heat)	Can be reduced in a **Precipitator** with lime. Can also be removed by **Ion Exchange** (2 methods): Cation exchanger, sodium cycle, plus strongly basic anion exchanger, chloride cycle . . . for lower equipment cost on small flow rates, no handling of acids or alkalis, no blending of effluents. Cation exchanger, hydrogen cycle, then neutralization by blending with softened water or addition of caustic soda ("H and Na treatment") . . . for lower equipment cost on high flow rates and reduction of total solids.
IRON OR MANGANESE Ferrous or Manganous compounds (dissolved), bicarbonates, etc.	Up to 50 ppm of Fe can be removed with cation exchanger, sodium cycle—if water is clear and unaerated. **Aeration, raising** pH with lime, **settling** (in catch basin or Precipitator) and **filtering** will remove iron. If raw water pH is high enough to cause iron to precipitate on aerating, the lime or settling or both may be omitted. **Manganese Zeolite** ("oxidizing filter") for water with up to 2 ppm of iron or manganese.
Suspended iron (ferric hydroxide)	**Sand filter**—sometimes with a coagulant such as alum added just ahead of the filter.
SILICA *(Turbine blade scale)*	**Hot process softener** (and anthracite filter) for low and medium pressure boilers. **Ion exchange** (demineralizing) for more complete silica reduction for high pressure boilers.

***Factors in selecting specific treatments include:** initial or operating cost or space limitations, plans for future expansion, characteristics of raw water, desired effluent quality and volume . . . and degree of operating skill available (automatic vs. manual operation, facilities for routine chemical testing, etc.).

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Vol. 105 No. 6

JUNE • 1958

A Scranton Gillette Publication

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WATER & SEWAGE WORKS

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Frank J. Schwemler, Commissioner of Water
Consulting Engineers—Havens and Emerson
Prestressed Concrete pipe by Price Brothers

Cleveland...

...uses Pratt Valves in a tight spot

City installations, with limited clearances and traffic problems, are never easy. This Cleveland project, tying a new booster station into two distribution lines, is about as tough as they come.

Here the specifications could not call only for "dependable valves" . . . it had to be "*dependable valves that are easy to install.*" This is where the engineer and contractor can tap the benefits of Pratt's long experience . . . major features of Pratt Butterfly Valves include exactly those things that simplify difficult jobs: minimum head room, versatile operators that can be buried without vaults . . . and design and construction such that the valve will always be easy to open or close.

If you would like to know more about Pratt Butterfly Valves, 40 page manual B2B is yours for the asking. *Henry Pratt Co., 2222 S. Halsted St., Chicago 8, Ill.* Representatives in principal cities.

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HENRY PRATT

RUBBER SEAT Butterfly Valves

BRIEFS

New British Reservoir, holding 6 mil gal, was constructed in Essex County, England, as a joint venture of two water companies to serve one million persons. A treatment plant to provide lime softening with activated silica coagulant aid, recarbonation and filtration were also constructed—page 223.

Water Tank Maintenance with suggestions for improving inspection and painting schedules—page 227.

Dear Bill: "How's your water works psychology working these days?" —page 230.

Taste and Odor Problems at Valparaiso, Ind., were solved with the proper application of activated carbon and chlorine. Close laboratory control aided—page 232.

Algae Effects on Dissolved Oxygen and Biochemical Oxygen Demand have been studied on the Fox River in Wisconsin and at the R. A. Taft San. Engr. Center in Cincinnati. In this first of three parts, part of the Wisconsin studies are reported—page 235.

Report of Illinois Section AWWA meeting presents abstracts of papers dealing with water softening, management and brainstorming—page 242.

Report on Dallas Convention of AWWA reviews highlights of meeting and abstracts of opening session. Reports on other papers will appear in the next issue—page 245.

The Uniflow Tank—Part II, presents the experimental studies which were used to confirm the soundness of design. Part I appeared last month —page 249.

High-Rate Digestion is evaluated by a professor well acquainted with the process, its operation, control, and results—page 255.

Anaerobic Digestion from the standpoint of the bacteria, rather than from that of the engineer or chemist, is an interesting concept presented by two professor-researchers—page 262.

Two New Staff Members and four new contributing editors have been added to the editorial department of Water and Sewage Works; another expanding service of Scranton Publishing Co. Inc.—page 264.

The Annual Reference Number of Water & Sewage Works will be published in August of this year. This is the 25th time this number has been issued. As usual it will be packed with important reference material published during the previous year. All subscribers receive this Number.

Only

Leopold

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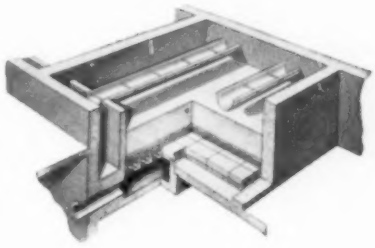
FILTER BOTTOMS

Successfully meet all underdrain requirements



Filter unit showing Leopold Filter Bottom and Leopold Fiberglass-Reinforced Plastic Wash Troughs

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In this design, laterals and distributing blocks form a permanent unit that assures equal filtration and uniform wash distribution with low loss of head. Made of de-aired fire clay—vitrified and salt glazed —the blocks can't corrode, won't absorb water, are acid and alkali resistant, and are not subject to tuberculation.

In addition, the Leopold Filter Bottom needs only a shallow depth of small-sized filter gravel, does not require supporting concrete structures, and is the only design providing a fixed and controlled secondary backwash.

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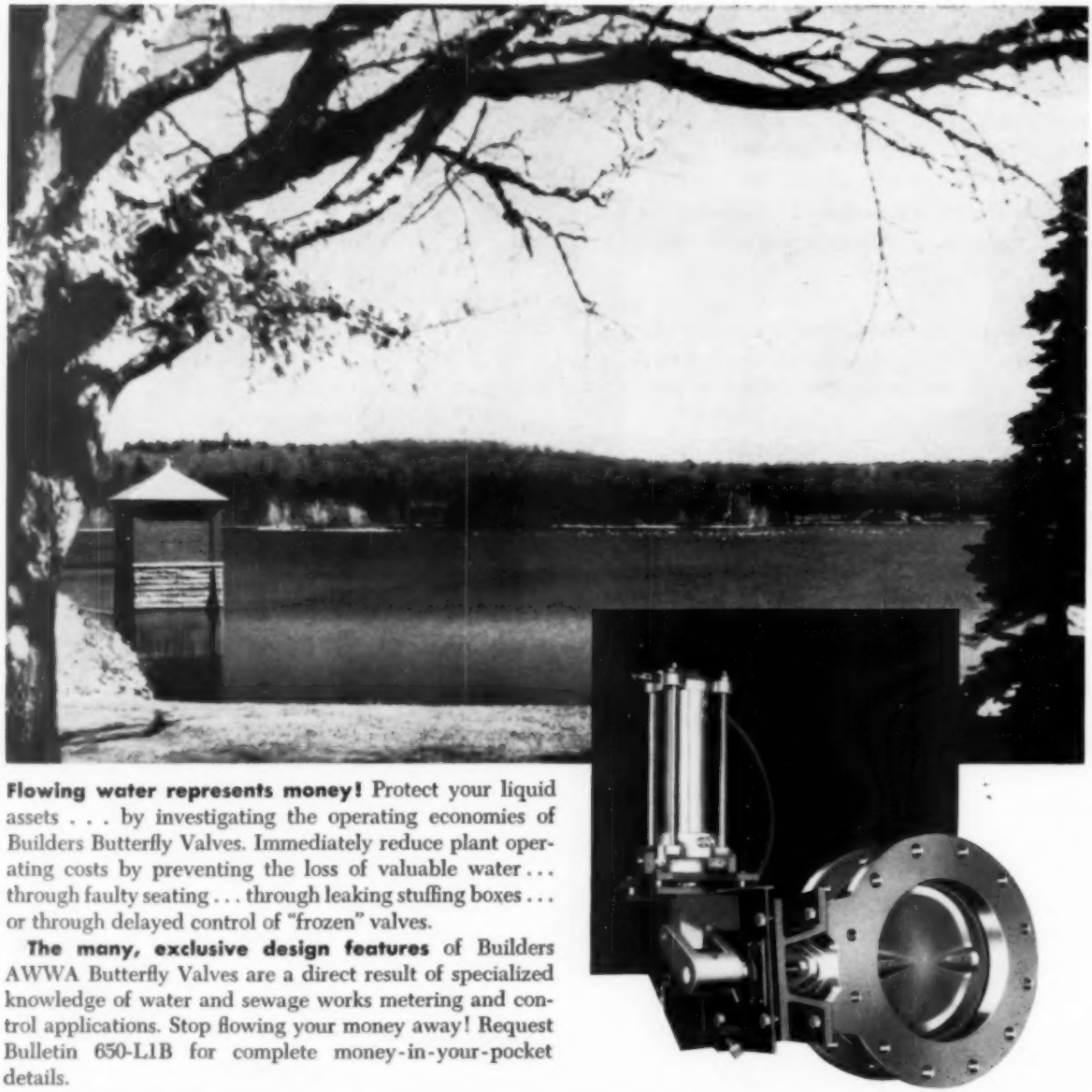

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News—Here & There

The Corpus Christi Story

reached a successful peak on April 26, when the new Wesley E. Seale Dam on the Nueces River was dedicated by Governor Price Daniels and Charles E. Wilson, former General Motors President and former Secretary of Defense.

For the first time in the history of the area, there will be plenty of water for future growth. The new dam will impound 300,000 acre-feet of water, almost ten times as much as the lake has supplied Corpus Christi since 1935. If necessary, the dam can be raised 10 feet to provide an additional storage of 200,000 acre-feet of water.

The dam was built and financed by an $18 million bond issue of the Lower Nueces River Water Supply District, created for the purpose. Title to the dam and storage lake will revert to the city when the bonds are paid off. The dam was named in honor of the former mayor and first chairman of the District.

Augusta, Maine, Water District

has issued its 53rd annual report. This is the 32nd report of Superintendent-Engineer S.S. Anthony. Because of the low precipitation last year, the surface supplies were inadequate and ground water from two gravel-packed wells was drawn on to supply 35.8 per cent of the demand. Algae growths in the pond were controlled by three applications of copper sulfate. Three main relocation projects were necessitated by the extension of the Maine Turnpike. Reimbursement for this expense was made under the terms of the Federal Interstate Highway Act.

Wisconsin Sewage Works Operators

met on May 16-17 in Mt. Horeb, Wis. The program included talks by Prof. G. A. Rolich of the University of Wisconsin on "Sludge Disposal" and by Prof. G. Lawton, also of the University on "Laboratory Control of Sewage Treatment Processes." A paper on "Waste Problems in the Paper Mill Industry" was also presented by a representative of one of the paper mills in the state.

Roger W. Esty

has been appointed Sales Manager of the Natgun Corp. of Boston, Mass. Mr. Esty, who is a past president of the New England Water Works Assn., has been associated with the Public Works Supply Co. of Lynn, Mass. He was formerly Superintendent of Water and Sewers at Danvers, Mass. In his new capacity, Mr. Esty will contact municipal and industrial customers in New England, with respect to the design and construction of composite wire wound prestressed gunite concrete tanks.

National Water Resources

are delineated in a recently published thesis by D. R. Woodward of the Dept. of Interior. According to Mr. Woodward's study the gross resources in the U.S.A. are equivalent to an average flow of 1,164 bgd. Only 314 bgd may be considered to be a reliable supply.

The study covered 17 river basins or groups of basins as to current and future availability of water for industrial use. In 1955, water use totalled 221 bgd including domestic, industrial and agricultural use. By 1980 the total needs will be 600 bgd, the increase being mainly due to industrial needs. Dependable sources in 1980 are expected to be about 500 bgd. The report suggests some ways of meeting the difference by 1980.

The report, "Availability of Water in the United States with Special Reference to 1980," is available from the Industrial College of the Armed Forces, Washington, D. C.

Domestic Water Supply Statistics

for the state of California have recently been released by E. A. Reinke, Chief, Bureau of Sanitary Engineering, Berkeley, Calif. The report covers data on all water supply systems in the state serving more than 200 customers. The data covers more than 725 water supplies and includes such information as place and owner, source and works, population served, water used, and chemical analysis of the supply. A revised and updated report will be published in 1960.

Drs. Ross E. McKinney and James M. Symons

have been promoted to Associate Professor and Assistant Professor, respectively, in the Department of Civil and Sanitary Engineering at Massachusetts Institute of Technology in Cambridge, Mass. The new appointments become effective on July 1. Both men are also associated with the consulting engineering firm of R. Eliassen Associates, Inc.

The Rice Institute

is now offering graduate work in Sanitary Engineering leading to the Master of Science Degree in the department of Civil Engineering. Students may participate in research activities on a part time basis during the school year and full time in the summer. Graduate assistantships provide exemption from fees and carry a stipend of $1500 for the academic session. For further information write: A. W. Busch, Asst. Prof., Dept. of Civil Engr., The Rice Institute, Houston 1, Tex.

Cartoon Captions

sometimes get switched, as was the case in our February issue, on page 75 and page 108A. J. S. Massey, Staff Engineer, Civil, American Viscose Co., Fredericksburg, Va., noticed the error. Both he and we wonder how many other readers were puzzled, rather than amused, by those cartoons with the wrong captions.

New England

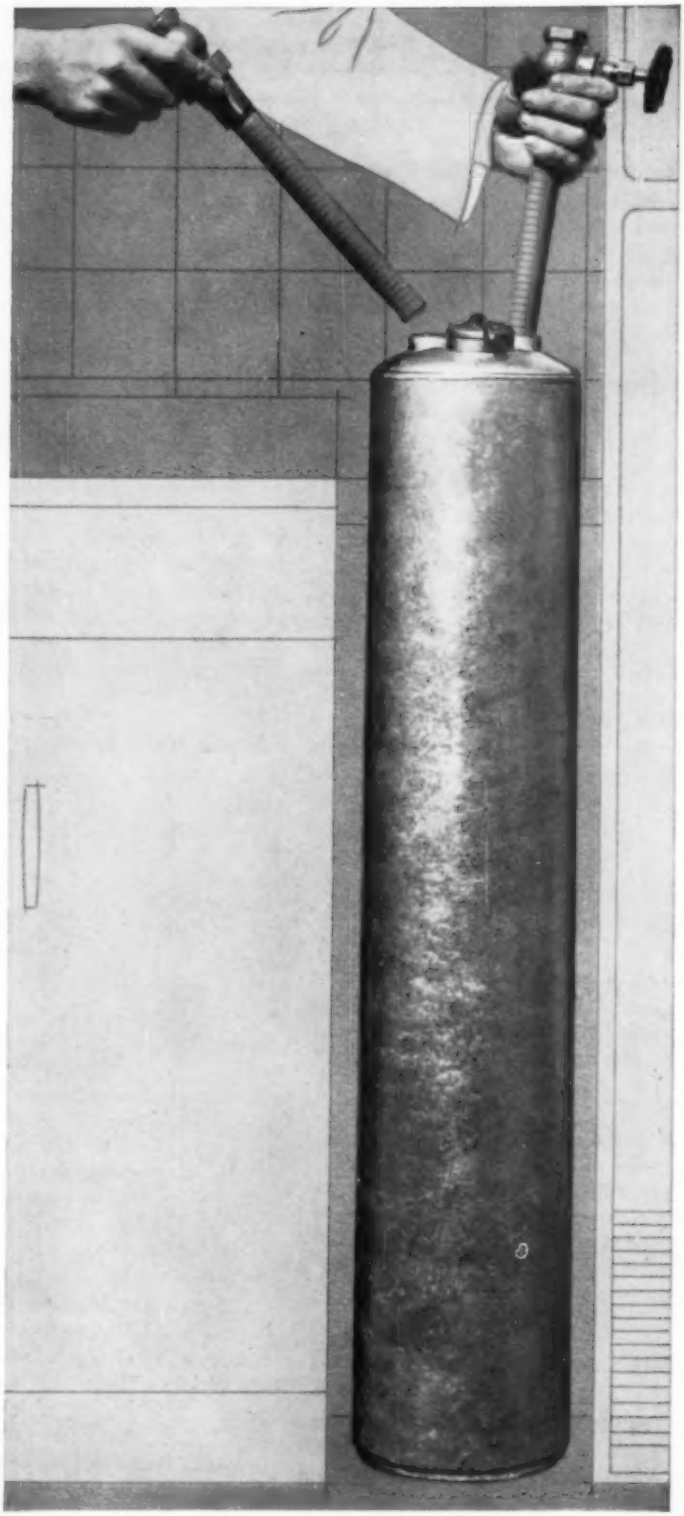
Interstate Water Pollution Control Commission has published its 10th annual report. In addition to sections covering administration and public relations, the report is largely devoted to activities in the several states. The status of classification of waters is shown.

CONTINUED ON PAGE 9A

USCOLITE PIPE

MR. USCO REPORTS:

THE PIPING that never needs replacement



To handle the highly corrosive brine used in regenerating this Cesco Water Softener, two lengths of Uscolite thermoplastic pipe are used. Uscolite is so highly resistant to the brine that *not one section of it has ever had to be replaced!* And there's no possibility of electrolysis due to the use of dissimilar metals. In fact, Uscolite® Pipe remains in such perfect condition that when the water softener tanks require replacement, the pipes are removed and used in new units.

Uscolite thermoplastic pipe is a product of United States Rubber. It is highly resistant to most chemicals, is extremely light, yet has very high impact strength. It just never seems to deteriorate.

A complete line of pipe and fittings (including unique UscoWeld* solvent-weld fittings)—plus the assistance of trained sales engineers who *know plastics*—is available at selected "U.S." Distributors, at any "U.S." branch, or contact us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.

National Sanitation Foundation Seal awarded to Uscolite Pipe

*Patent applied for.

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News—Here & There (continued)

Improvement in pollution abatement since 1947 is shown by these figures:

	1947	1957
Population served by sewered communities	7.63 mil	7.815 mil
Receiving treatment	39%	61%
New Construction	——	17%
Plans Approved	——	6%

Between 1947 and 1957, communities involved in enlargement or modernization projects served a population of 1,452,000. At the end of the ten-year period, 54 per cent of these projects were completed and 25 per cent were under construction while 21 per cent have plans approved or in preparation.

The report also covers industrial waste research in the Compact area, radioactive wastes, boat pollution control, and state and Federal legislation pertaining to stream pollution control.

Parsons, Brinckerhoff, Hall & McDonald

consulting engineers of New York City publish a house organ titled simply, "Notes." In addition to stories on present and future construction projects the bulletin contains thumbnail sketches of three staff members of the firm. One of these is Eugene A. Hardin, who is Project Engineer on the four-mile long raw water tunnel and intake structure which will serve the suburban communities of Wayne County, Mich. He is also in charge of the master planning of the sewer system for the city and parish of Baton Rouge, La. Before joining the firm, "Gene" served the Dept. of Public Works in Philadelphia, in charge of design of water works and sewage treatment plant facilities.

Bayerische Biologische Versuchsanstalt

will hold an Advance Course in the "Problems of the evaluation of the water quality of streams and of sewage and industrial wastes" from Oct. 6 to 10 under the direction of Prof. R. Demoll and Prof. Dr. H. Liebmann. Any persons interested in attending this course can register by writing before Sept. 15 to Prof. Dr. H. Liebmann, at the above named Institute in Munchen 22, Veterinarstrasse 13, Germany.

The N. J. Section AWWA

has published a complete listing of officers and committee members for the current year. The list has been distributed to all members of the section. Other sections perform a similar service for their members through regular bulletin publications.

Illinois State Water Survey

publications have been listed in a small brochure and addendum. Since its inception in 1895, the Survey, located at the University of Illinois in Urbana, has published 45 bulletins, 35 reports of investigations, 69 circulars, and 8 miscellaneous items.

Saline Water Conversion

should be pushed faster according to Senator Clinton P. Anderson (D-N. Mex.) who has sharply criticized the Office of Saline Water for not making more progress. OSW Director David S. Jenkins, says progress is going forward as fast as possible with the funds available. A planned pilot plant to cost $1 million can not be started because funds are not available. Senator Anderson is sponsoring a bill to authorize construction of a $10 million demonstration plant in California. Sen. Francis Case (R-S. D.) is sponsoring a similar bill to include the California plant and a demonstration plant for brackish water conversion in the Great Plains.

Additional Federal Money

for the construction of sewage plants is being pushed by Rep. John A. Blatnik who authored the $50 million dollar a year grant program two years ago. This grant program has been shown to be effective and Rep. Blatnik believes that doubling the program will aid in fighting the recession. The American Municipal Assn. and several Congressional Democrats are urging such action.

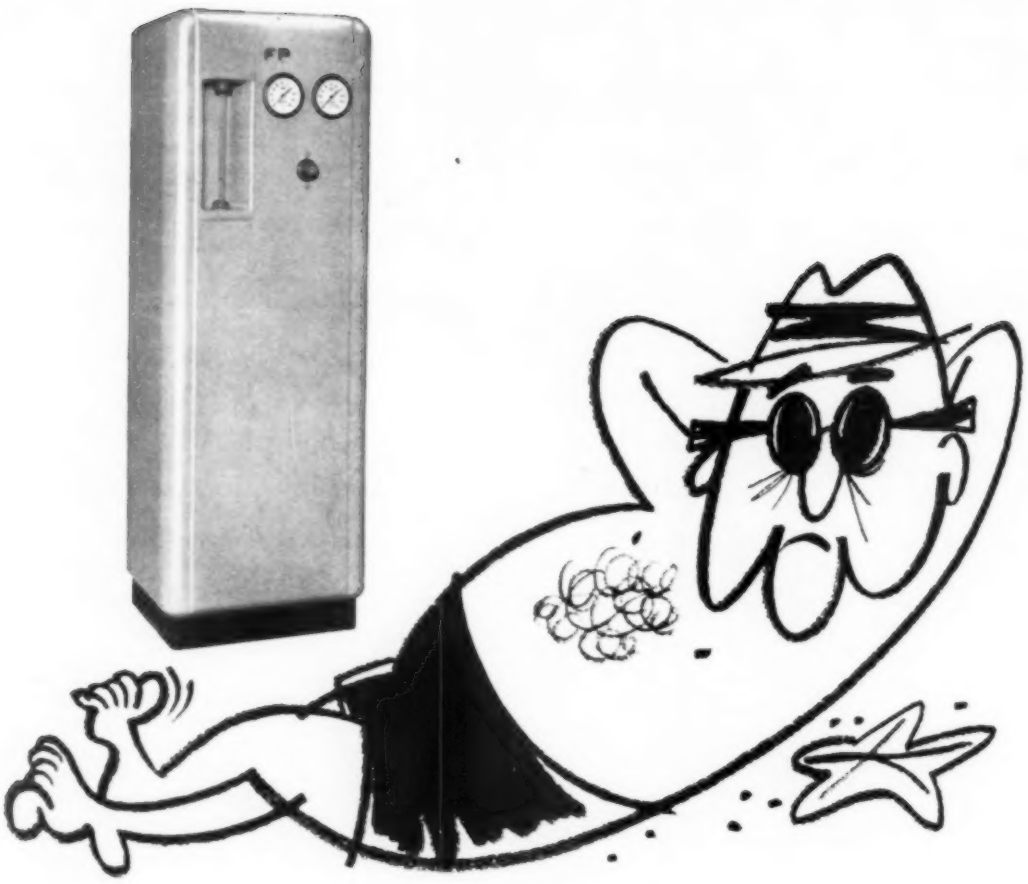
Not only would this legislation, if proposed, double the total amount of the grant program, but it would double the limit on grants for each project. It is believed that such an increase in the program would stimulate sewage works construction to reach a peak of $600 million a year, as opposed to last year's construction volume of $351 million. The Administration opposes the increased program and wants the states to take back the responsibility for financing sewage works construction.

Water Mortgages

may be solved to some extent by nuclear technology according to G. W. Johnson of the Univ. of Calif. Radiation Lab. As a result of last fall's underground nuclear explosion, Mr. Johnson believes that such explosions may be used in dry river channels to produce progressive caving all the way to the surface. The cruched ruck would act as an artificial aquifer to store water from flood runoffs and feed it to permeable subsurface strata.

Coming Articles in Water & Sewage Works

Algae Effects on D.O. and B.O.D.	*A. F. Bartsch*
Aluminum Covered Reservoir	*W. C. Renshaw*
Digester Net Effective Capacity	*L. L. Langford*
Field Testing Centrifugal Pumps	*F. W. Beltz*
Membrane Filters	*J. A. McCarthy*
MPN Coliform Index	*E. J. Laubusch*
Turnpike Service Areas	*W. F. Middleton*
Sewage Aeration	*John Finch*
Split Flow Treatment	*Lloyd Owens*
Telemetering and Remote Control	*Wilkerson and Moseley*
The Budget	*W. R. La Due*
Use of Tank Car Chlorine	*Harwood and Haw*



Technological unemployment they calls it...

It's a terrible thing to be put out of business by a machine. Used to be I was the hottest chlorinator fixer in the country. Travelled up and down the coast from job to job. And the pay was better than good.

OH! the fun I had till Fischer & Porter walked in with that new chlorinator! What with all kinds of special materials and fancy diaphragm regulators it hardly ever needed fixing at all.*

Still, I figured it would be twenty years before anybody would take a chance on such new-fangled tomfoolery. Why it didn't even *look* like a chlorinator!

Next thing I knew, those Fischer & Porter Chlorinators were springing up like so many mushrooms. And where one of them appeared, seems like *two* of the old-fashioned kind were cashiered out. Still it took five years for me to see the handwriting on the wall and retire.

• • •

Now, a word to the wise is supposed to be sufficient. If you'd rather not be dependent on chlorinator repairs, why not get the facts on new-fashioned chlorinators from Fischer & Porter Co., 168 Fischer Road, Hatboro, Pennsylvania.

FISCHER & PORTER CO.

Instrumentation and Chlorination

*Any wonder everyone's *trying* to copy F&P's design now?

Equipment News

Capsule Form Mosquito Larvicide

601

Wyco International, Cleveland, O., has available Tossits, the new larvicide that kills mosquito larvae, that is being more widely used in park systems and for water and sewage facilities in municipal systems. Tossits are capsules that dissolves in minutes, spreading a lethal film in all directions on the surfaces of the water. Swamps, canals, catch basins, rain pools, ditches, all the stagnant waters that are breeding pools for mosquito larvae, are ideal for using Tossits. One capsule will larvicide 100 to 750 feet of water.

Low Cost Recorder

602

Leupold & Stevens Instruments, Inc., Portland, Ore., has introduced a recorder that provides accurate low cost graphic and visual registration of liquids flow for sewage treatment plants and other installations. This recording, indicating and totalizing meter measures liquid flow over Parshall flumes and weirs.

The recorder features interchangeable flow cams and flow conversion gears. This is an important economic factor to sewage treatment plants and in other installations here liquid flow may increase substantially beyond originally anticipated limits. With a simple change of cams and gears, the Stevens Type B-FT recorder can operate with a different size flume or accommodate a greater range of flow than that for which it was originally purchased. The change does not require factory service. Similarly, change from weekly to daily graphic time scale, or vice versa, is accomplished by merely repositioning one gear.

The recorder can be direct float operated or remotely controlled and is available for wall or switchboard mounting, or with cabinet for mounting out-of-doors directly over the float well.

New Classifications for Transite Pipe

603

Johns-Manville Pipe Division, New York, N. Y., has announced that greater efficiency in sewer design and layout will now be possible through the development of new classifications of crushing strength for Transite Pipe.

Through improved manufacturing methods, Transite will now be available in a variety of the more widely needed crushing strengths: 1500, 2400, 3300, 4000, and 5000 pounds. They will be available in eleven different diameters ranging from 6" to 36".

Engineers will be able to select pipe on the basis of depth of cut, width of trench, type of soil and manner of bedding.

Interconnection between different classes of the same size can be made simply and without the use of special adaptors. At the same time the exclusive Ring-Tite Coupling will be maintained to insure tightness at joints.

Vinyl Primer Added to Corrosion-Control Coatings

604

Prufcoat Laboratories, Inc., Cambridge, Mass., has announced a new Prufcoat Vinyl-Weld Primer. This new primer is formulated to tolerate moisture encountered on damp metal surfaces, making it possible to secure good vinyl coating applications in in-

CONTINUED ON PAGE 13A

Crispin

AIR VALVES
are thoroughly
dependable

For positive air control use Crispin Air Valves. Simplified construction, easy accessibility, maximum dependability, minimum maintenance, and efficient operation are advantages built in every Crispin Air Valve.

Crispin
MODEL "P"
AIR VALVES
...eliminate air in pipelines, pumps, tanks and other vessels—durable stainless steel seat and synthetic plunger resist attack of many liquids.

Crispin
DUAL VALVES
...safely release air during line filling and while it is in operation, permit air to enter as line is emptied—low-cost 3-way control.

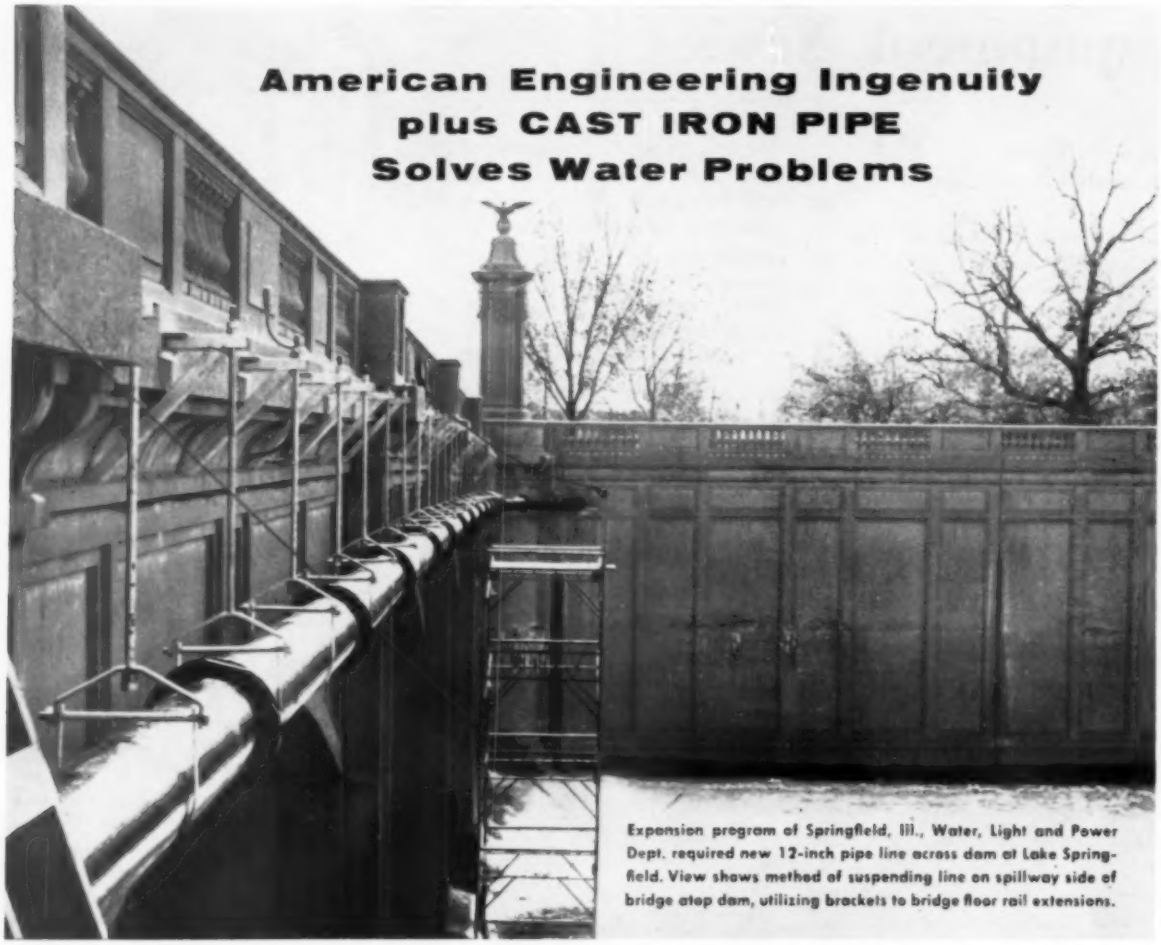
Crispin
TURBINE VALVES
...control air from inlet through outlet. Strains out foreign substances. Particularly useful with automatic priming systems of centrifugal pumps.

Write, wire or phone for complete information on dependable Crispin Air Valves that keep your pipelines open for safe, economical operation.

AIR CONTROL VALVES FOR OVER 45 YEARS

multiplex
MANUFACTURING COMPANY
BERWICK, PENNSYLVANIA
Dept. B

American Engineering Ingenuity plus CAST IRON PIPE Solves Water Problems



Expansion program of Springfield, Ill., Water, Light and Power Dept. required new 12-inch pipe line across dam at Lake Springfield. View shows method of suspending line on spillway side of bridge atop dam, utilizing brackets to bridge floor rail extensions.

More and more American communities are experiencing water shortages. This is due largely to outgrown facilities for water distribution.

According to an inventory by the Defense Services Administration, 42% of the public water supplies are inadequate. Unless prompt steps are taken by many communities to expand water systems, water shortages will become more acute — more widespread, since daily water use for municipal supplies in the U. S. A. is increasing by leaps and bounds.

Prolonged municipal water shortages cause untold inconvenience to all citizens. They menace public health, endanger public safety, cause industry shut-downs and hold back community growth.

If your community has not yet appraised its future water needs, now is the time to do so. When plans are made to expand your water system, be sure to choose the pipe that has stood the acid test of century-long service:

Permanent

CAST IRON PIPE

Cast Iron Pipe combines the advantages of permanence and minimum upkeep with superior shock resistance to flood, earthquake and explosion. It has earned its reputation as

"America's No. 1 Tax Saver."

Our Company does not manufacture Cast Iron Pipe but has long supplied the nation's leading foundries with quality iron from which quality Cast Iron Pipe is made.

WOODWARD IRON COMPANY

Since 1882

WOODWARD, ALABAMA

Equipment News

CONTINUED FROM PAGE 11A

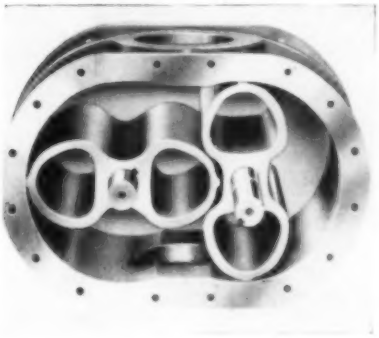
stances where surface dampness cannot be completely eliminated before the primer is applied. Thus, it overcomes one of the most troublesome obstacles to effective control of corrosion with vinyl protective coatings in many chemical process and other industrial plants.

It may be applied by ordinary brush, spray and roller methods, and is particularly well suited for increasingly-popular hot spray application. Consequently, it makes an excellent companion product for Prufcoat Hot-Spray Vinyl—a chemical—resistant coating that provides as much as 10 mils coating thickness in just one application and frequently accounts for application labor savings as high as 50%.

Field-Adjusted Rotary Blowers

605

Sutorbilt Corp., Compton, Calif., has developed a new "California" series of positive pressure rotary blowers for heavy service with wide face herringbone gears and an exclusive timing hub for easy field adjustment.



The wide face herringbone timing gears hold rotating impellers in alignment, minimize lateral thrust under load, maintain impeller clearances and eliminate head plate contact.

Maintenance personnel can adjust impeller clearances without removing the unit from the line. Blower can be retimed in the field without removing the gears, thus greatly reducing downtime.

The new units are designed and built to deliver air or gas in capacities of 10 to 1100 cfm and pressures and vacuums of zero to 10 pounds. Larger units are available in capacities to 20,000 cfm at same pressures. They are used for sewage disposal, water distillation, flotation, aeration, ventilation, pneumatic conveying, forced draft of combustion air, inert gas pressurizing systems, etc. Impellers are separated by minute clearances which are controlled by the timing gears. Blowers standardly operate bottom inlet and top discharge, but can be reversed for bottom discharge if desired.

They can be direct driven from power source through a flexible coupling or can be connected by V-belt drive for variable speeds. Base can be slotted for belt take-up.

These blowers are designed for continuous operation at conservative speeds. Case, headplates and impellers are of close grained cast iron. Large alloy steel shafts are ground and polished. Blower bearings are anti-friction type and are protected by grease and oil seals. Timing gears are semi-steel and run in an oil bath. Breathers prevent contamination of air by blower lubricant.

Joining Strips for PVC Sheeting

606

The Colonial Plastics Mfg. Co., Cleveland, Ohio, has announced the development of joining strips, applied with solvent welding for fabrication of PVC tanks, ducts and other fabrications. The joining strips are designed to replace hot air welding of PVC stock and thereby reduce assembly time. The manufacturer states that on major fabrications, costs have been cut 30 per cent.

The strips are available in 90 degree strips for making corners, and H strips for use in a single plane. The strips are made of both normal and high impact PVC in standard lengths of 10 ft.

The slots of the joining strips fit tightly at the outside edge to provide their own clamping pressure. They are also designed to eliminate hydraulic lock.

CONTINUED ON PAGE 17A

• Metallurgy Tests

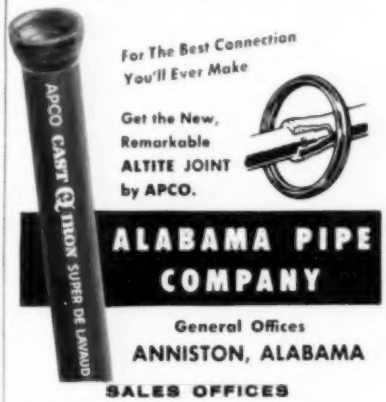
• Hydrostatic Test Press

• Load Bearing Tests

CAST IRON PIPE
By
APCO

Quality Controlled from raw materials to finished product through exacting metallurgical, chemical and physical test.

Modern long lengths in sizes 3" to 24"—Bell and Spigot, roll-on, flanged and mechanical joint.



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ANNISTON, ALABAMA

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350 5th Avenue New York 1, New York
950 Dierks Building Kansas City, Missouri
18505 West Eight Mile Rd. Detroit 41, Michigan

"Transite's installation recent increases

Says Philip J. Holton, Jr.
Chief Engineer
Water Supply Board
Providence, R.I.

"Our records show that labor and material costs have increased 100% since 1946. Yet, in this same period of time, our installation costs have increased only 21%. The ease of handling and speed with which contractors can lay Transite Pipe enable us to take full advantage of modern equipment and methods. In this way, Transite has played a prominent part in helping us offset increased costs."

Transite Pressure Pipe helps you cut system costs 3 ways: in design . . . installation . . . operation!

Today, in every part of the nation, municipal and consulting engineers choose Transite® Pressure Pipe. Ask why, and you find that economy is always among the Transite advantages they consider most important. For no pipe does so much to help keep your costs low in three different areas:

1. Design. Transite lets you plan a system for maximum efficiency. For its high carrying capacity (flow coefficient, C=140) often lets you specify pipe of smaller diameter. And because Transite's smooth interior remains smooth, you never need to make costly allowances for future reduction in carrying capacity.

2. Installation. Transite's installation speed cuts time and labor costs substantially. Light in weight for so durable a pipe, it handles easily above and below ground. And its Ring-Tite Coupling assembles quickly, surely . . . giving you a tight seal at every coupling in the system.

savings have helped us absorb in labor and material costs..."

Crews of Fanning and Doorley Construction Co. installing 8" line in Providence, R. I.

3. Operation. Here's where Transite really saves! For its maintained carrying capacity keeps pumping costs low year after year. Its strength, durability and corrosion resistance cut maintenance to a minimum, provide years of trouble-free service.

Transite's Ring-Tite Coupling cut away to show how rubber rings are compressed and locked in place to form a tight yet flexible joint.

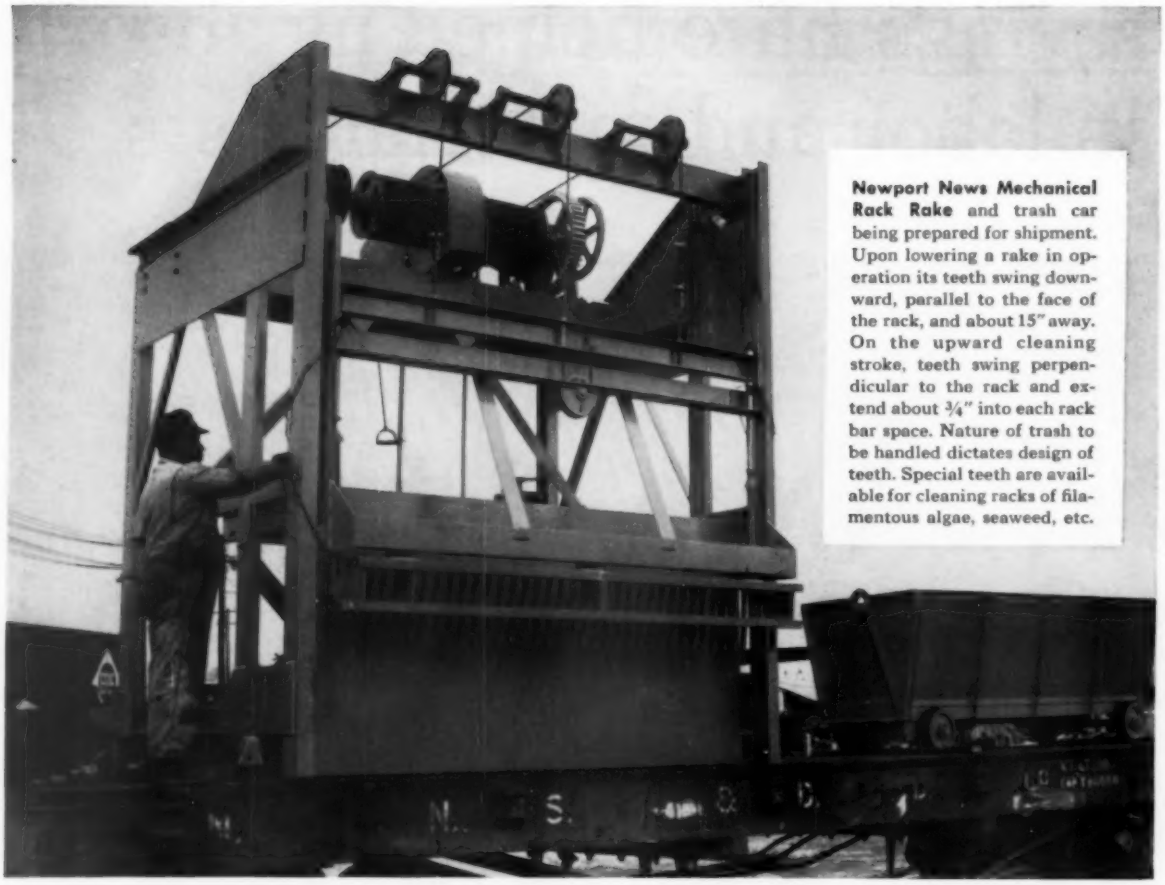
We'll be pleased to send you booklet TR-160A. Write Johns-Manville, EN Box 14, N. Y. 16, N. Y.

"Good Water, the Lifeblood of your Community" Let's promote it—Let's have it!

JOHNS-MANVILLE

100 YEARS OF QUALITY PRODUCTS . . . 1858—1958

JOHNS MANVILLE JM PRODUCTS



Newport News Mechanical Rack Rake and trash car being prepared for shipment. Upon lowering a rake in operation its teeth swing downward, parallel to the face of the rack, and about 15" away. On the upward cleaning stroke, teeth swing perpendicular to the rack and extend about ¾" into each rack bar space. Nature of trash to be handled dictates design of teeth. Special teeth are available for cleaning racks of filamentous algae, seaweed, etc.

Positive cleaning action calls for guided rack rakes

Excessive loads of trash cannot push a Newport News rake away from the racks.

And there's no chance of the rake *riding over trash* on the upward cleaning stroke. Nor will its teeth drop the debris. Because Newport News builds the rake to operate in channel guides... for *positive cleaning action.*

That's why efficient rack cleaning assures the maximum head at intakes and is yours when you put a rugged and dependable Newport News Mechanical Rack Rake on the job.

Maximum width of a single rake is determined by design of the forebay. Where a single bay is extremely wide, intermediate guides are sometimes installed to reduce width of the rake. Such installation is relatively inexpensive.

A power-operated Newport News Mechanical Rack Rake, under ordinary conditions, enables one man per shift to keep racks clean for a dozen bays, from 5'-6" to 28'-6" in width.

Trash is cleaned from the rake manually, or by a mechanical "sweep", into a flume, a car or onto a trash apron. Local conditions and nature of the trash dictate method of disposal. The many typical installation arrangements fit most needs, but each installation is a custom built job.

We invite inquiries from water users who are troubled with trash. Write for your copy of "RACK RAKE", an illustrated booklet describing the operation and advantages of the Newport News Mechanical Rack Rake.

Newport News
Shipbuilding and Dry Dock Company
Newport News, Virginia

Equipment News

CONTINUED FROM PAGE 13A

Sonic Filter for Sewage & Wastes

607

United Specialties Co., of Ill., Chicago, Ill., has announced that the Novo sonic filter is proving its range of capabilities in de-watering and classifying slurries of high water content.

The sonic filter consists of a screen or sieve mounted in trough-like form above a filtrate funnel. The effluent, or materials being filtered from the liquid, rolls off the end of the screen.

One edge of the rectangular screen is firmly clamped to the frame of the machine; the opposite edge is vibrated through a metal frame by means of an electro magnetic vibrator. Upon the basic oscillation of 120 cycles per second, very high harmonics are built up.

According to the company, many cases where the Novo filter has worked on sewage and industrial waste, the quality of the filtrate has many times been improved to the point where it can be dumped into streams with no further treatment.

Reinforced Epoxy Pipe

605

Amercoat Corp., South Gate, Calif., has announced that corrosion-resistant reinforced plastic pipe, strong as steel

but only one-eighth the weight, is now being manufactured in 2 to 12 inch diameters to meet piping, tubing and ducting needs in the plant.

Known as Bondstrand, the new pipe, using a patented process employing interwoven fiber glass filaments,

CONTINUED ON PAGE 19A

KUHNS

DUCTILE IRON PIPE FITTINGS*

If your biggest maintenance problem is downtime for replacing fittings, you'll be interested in the money saving advantages of Kuhns Ductile Iron Pipe Fittings.

Their superior corrosion resistance, high strength and ability to withstand shock assure extra years of service, help reduce operating costs and simplify maintenance. Their smooth bore helps eliminate clogging, keeps systems working at maximum efficiency.

Wide Selection With a complete line of cast iron fittings and the newly developed ductile series, Kuhns offers the *right* fitting for practically every purpose. Choose from all types of flanged fittings from 1½" through 12"; companion flanges from 1" through 12"; screwed fittings from ¼" through 12". Over 3000 sizes and shapes, available coated, galvanized or uncoated to meet your specific requirements. Write for full details.

*Kuhns ductile fittings are listed and pressure rated by the Underwriters' Laboratories, Inc. All Kuhns fittings are available nationally through better wholesalers.

K

THE KUHNS BROTHERS CO.
1800 McCALL STREET • DAYTON, OHIO

1887 • 70 years of continuous progress • 1957

AMPLE DEFLECTION

Photo shows how easily Clow Bell-Tite joints handle casual curves or normal grades without fittings.

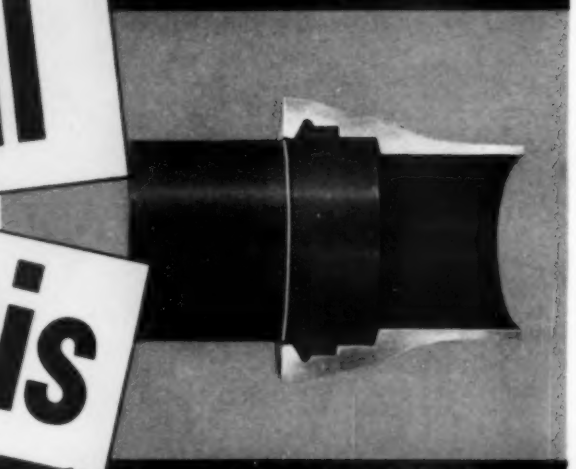
TIGHT JOINTS

Full length, restrained joint, bursting tests prove Bell-Tite joint, even fully deflected, is stronger than the pipe.

you get all this with

FAST INSTALLATION

Above, Clow 8" Bell-Tite pipe being installed at the rate of 25 joints per hour. No bell holes are required.



SIMPLE ASSEMBLY

Wipe clean, lubricate, and push spigot into bell. When painted yellow stripe disappears, joint is bottle-tight!

CLOW BELL-TITE JOINT*

cast iron pipe

Here's the new time-saving, labor-saving, money-saving way to lay watermain. A single gasket, rubber seal joint that requires no bolts or follower glands to make a tight, dependable joint. Listed by the Underwriters' Laboratories, Inc., for water working pressures up to 350 psi, the pipe itself meets all applicable provisions of AWWA, ASA, and Federal Specifications. Complete details gladly rushed to you on request.

*Patent applied for.

SINCE 1878

JAMES B. CLOW & SONS, Inc.

201-299 North Talman Avenue, Chicago 80, Illinois

Subsidiaries:
Eddy Valve Company, Waterford, New York
Iowa Valve Company, Oskaloosa, Iowa

Equipment News

CONTINUED FROM PAGE 17A

impregnated with epoxy resins and heat cured comes in rigid 20-feet lengths with ends plain, bell-and-spigot or flanged. Other lengths, as well as diameters up to 40 inches, are available on special order.

The pipe is nontoxic, nonflammable and collapse-resistant, and does not cold flow or sag in use. It may be used for most petroleum and chemical products; sewage and industrial wastes and gases; fresh and salt water; foods and pharmaceuticals; and as structural tubing and conduit.

Its smooth, friction-free interior surface resists scale and paraffin deposits, assuring full rate of flow for the life of the pipe.

The pipe is easily cut and joined in the field and requires no special tools. The basic joint is made simply by placing the spigot end of one pipe into the bell end of the next. An O-ring and a tapered sleeve, both secured with a special adhesive, seal the joint permanently against leakage.

Flow Transducer

609

The Ramapo Instrument Co., Inc., Bloomingdale, N. J., has announced the development of a new version of its Mark V Flow Transducer. This new model features housings with welded steel flanges in all nominal pipe sizes and extends the application of the Mark V to cover virtually any industrial flow requirement, subject only to a 10-1 range limitation on any single transducer. Since the instrument is phase sensitive, it automatically detects direction of flow and will indicate accordingly.

The flow transducer is constructed of stainless steel, has no bearings or moving parts and is, therefore, particularly suitable for use with acids, caustics and other difficult liquids. The electrical output of the unit, which is strain gage translated, can be applied to a variety of commercial indicators, recorders or controllers and is easily adapted to telemetering applications. Accuracy of these units is ½%.

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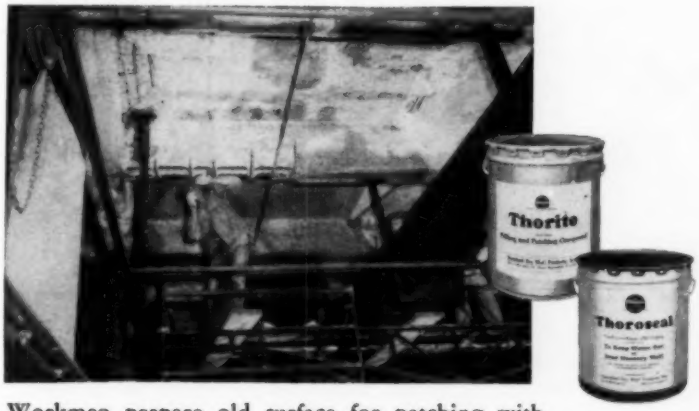
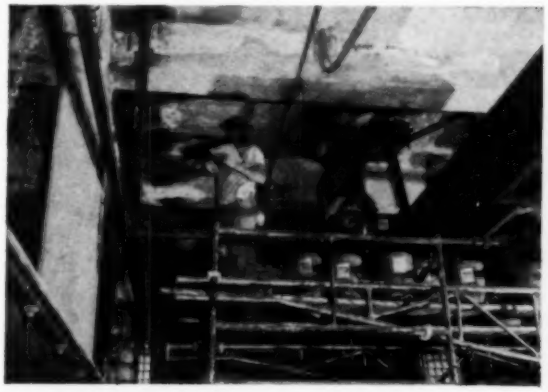
How THORITE and THOROSEAL made this underground structure sound again!



Workmen prepare old surface for patching with THORITE.

Water has entered the concrete and caused corrosion of reinforcing rods, blistering the concrete off surface and causing structural weakness throughout building.



Reinforcing was cleaned, all corrosion was removed and brush coat of THORITE applied over entire patching area, then filled in with trowel coats of THORITE, even with surrounding surfaces.

THORITE Patching Mortar sets in 20 to 30 minutes and can be coated with THOROSEAL while hardening.

"How to do it" GET OUR 16 PAGE BROCHURE

STANDARD DRY WALL PRODUCTS, INC.
NEW EAGLE, PENNA. CENTERVILLE, IND.

HERSEY
WATER METERS
YOUR BEST BUY

Contact Nearest Branch or Home Office for Complete Information

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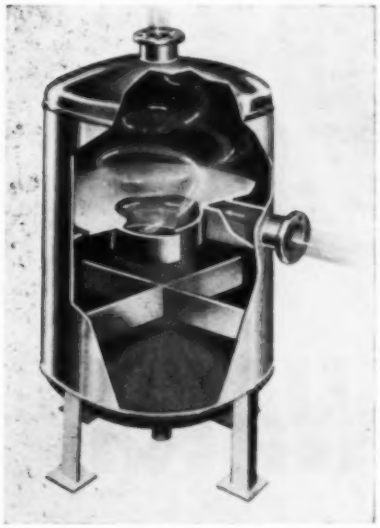
Equipment News

CONTINUED FROM PAGE 19A

Sand Separator 610

Walter R. Cole & Co., Oakland, Calif., has introduced a new method of removing sand and silt from water.



With sand removal efficiencies close to 100%, the Cole Sand Separator is designed for system requiring automatic valving and other hydraulic components subject to fouling from small sand or silt particles.

According to the company, this unit is the first to use a two chamber system—one to separate heavier particles through a centrifugal-helical action utilizing water at high velocity, and one to separate residual fine particles by reducing the water velocity below the "fall out" velocity of the very fine particles. Virtually complete sand removal is attained with little pressure drop (2 to 4 psi) and large gpm fluctuations have no effect on efficiency. The Cole Sand Separator is available in standard models covering a wide range of pressures and capacities.

Sand-laden water enters a volute which forces water into a helical-centrifugal path while increasing its velocity. Solid particles are forced to the outer periphery of the volute where they are allowed to escape into the settling area through a slot at the edge. Accumulated sand can be discharged through a bottom control valve.

CONTINUED ON PAGE 23A

CLEVELAND TRENCHERS

DIG CLEAN
• to exact width and depth specifications
• to perfect grade
• straight and fast

SAVE MORE
• on backfill material
• on hand finishing
• on right-of-way damage

MAKE MORE
• by higher production in all soil conditions
• with lower cost for all trench work

CLEVELAND 80W

LAYS PIPE
• large capacity side boom
• long reach

FILLS TRENCH
• fast, clean
• from either side

TAMPS FILL
• to compaction specs
• simultaneous with backfill

Before you bid your next job contact your local Cleveland distributor

The CLEVELAND TRENCHER Co.

20100 ST. CLAIR AVE. • CLEVELAND 17, OHIO

Good Everywhere ®

40% MORE 40% WATER

can flow through the NEW Layne 134 shutter screen

WHY? *Increased inlet area!*

Here's a screen that is even more efficient . . . has *greater strength* than the long-lasting Layne 96 shutter screen that made Layne water wells famous.

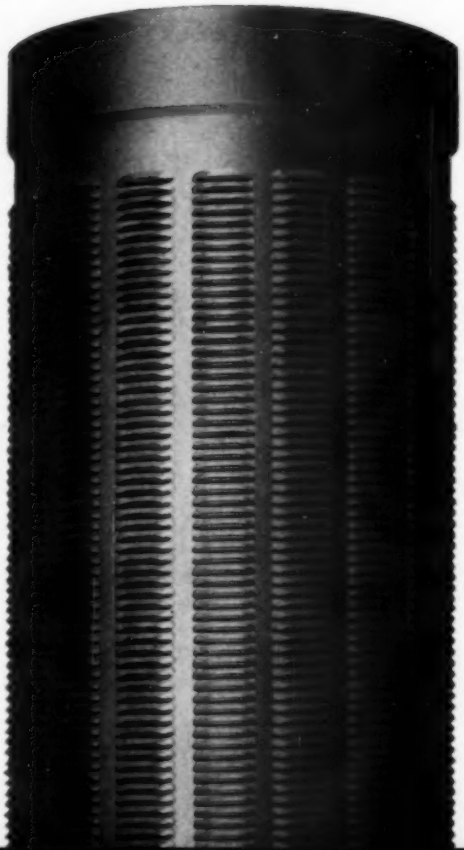
This new development of Layne creative research is used only in Layne water well installations, and available exclusively through Layne Associate Companies.

Contact your nearest Layne Associate Company for complete details.

LAYNE & BOWLER, INC. MEMPHIS
General Offices and Factory
Memphis 8, Tenn.

Layne Associate Companies throughout the world.

WATER WELLS
VERTICAL TURBINE PUMPS • WATER TREATMENT



Layne

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LOUISIANA WELL COMPANY
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• For further information on products or services please use reader service card.

Equipment News

CONTINUED FROM PAGE 21A

Self-Sealing Coupling

611

Dresser Manufacturing Div., Dresser Industries, Inc., Bradford, Pa., has developed a new Style 200 "Aquapak" self-sealing coupling that makes possible speedy, simple and low cost joints on underground steel water lines.

The coupling consists of a steel body with a specially designed gasket. The gasket has three sealing lips which combine with internal water pressure to form the seal. The "Aquapak" is available in a range of OD sizes from 4" to 12¾".

The "Aquapak" reaches the user completely factory-assembled. There are no loose parts. Gaskets are assembled in the coupling and need not be removed prior to installation.

These couplings also possess "give-and take" flexibility which permits curves to be laid with straight sections of pipe. Tests have proved that the coupling can accommodate pipe deflections up to 4°.

Flow Switch Starts and Stops Auxiliaries From Liquid Flow

612

McDonnell & Miller, Inc., Chicago, Ill., has developed a new series of flow switches.

The new series—known as FS4 Series—was developed to meet the need for a dependable device at moderate cost to activate a signal, pump, burner, alarm, meter, or other similar equipment, when flow of liquid in a pipe line starts or stops. The flow switch is easily installed in a tee on a horizontal run of pipe with the paddle extending down into the flow. Any flow of liquid in the pipe moves the paddle and closes the switch to complete an electric circuit which remains closed until flow ceases. Reverse acting type is also available to open circuit when flow starts; close, when flow stops. Sensitivity to flow can be readily adjusted.

Swimming Pool Filter

613

Jacuzzi Bros., Inc., Richmond, Calif., has developed an improved type of filter, the Jacuzzi Crystal Flow for swimming pools.

The filter, which is available for either concrete or liner swimming pools, operates as a diatamaceous earth filter and skimmer, with automatic weir. The high efficiency of the Jacuzzi Crystal Flow permits its effective use in larger pools up to 33,000 gallons, or approximately 20 by 40 feet.

Since the new type filter requires a minimum of piping and no vacuum fittings, it is competitive in price with sand-type filters. The Crystal Flow filter-skimmer tank is made of long-life copper.

The new filter is installed flush with the deck of a pool. The main drain line operates by syphon action to the diatamaceous earth filter. There is no "back wash" cycle, a cleaning operation prohibited in many areas.

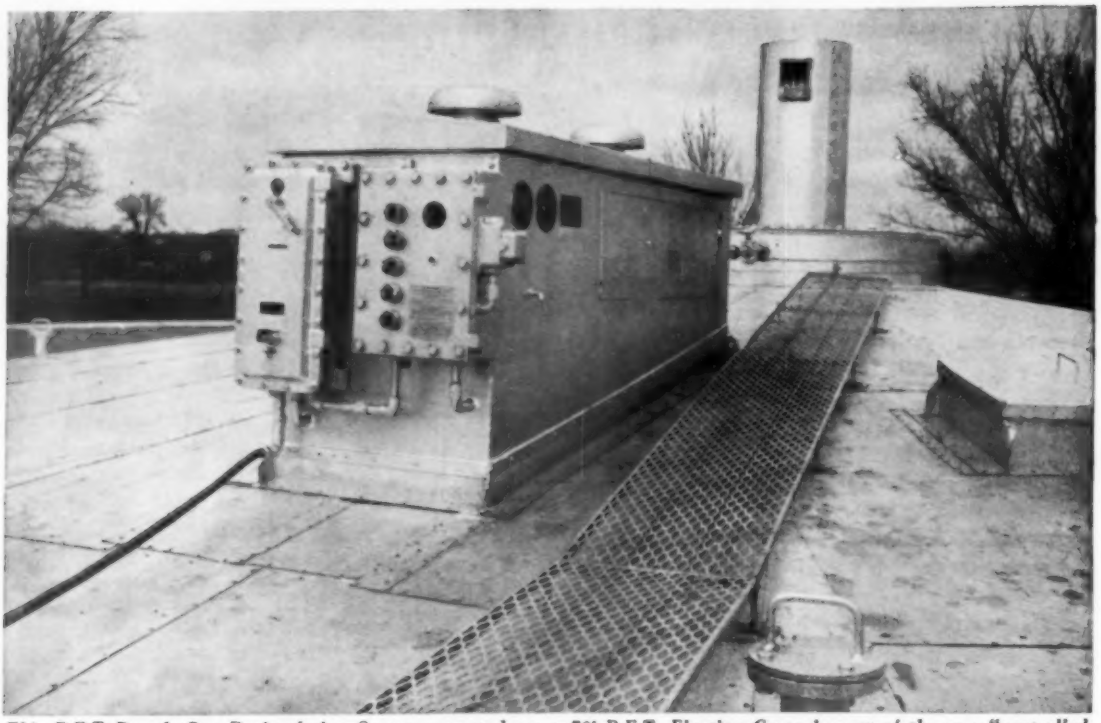
Plastic Welding Equipment

614

Laramy Products Co., Hingham, Mass., has developed two new high speed plastic welders.

One, the Kamlar Model HT, is fitted with a standard welding tip or with a high speed tacking tip that permits rodless tacking. The tip is simply moved along the seam and fuses the edges strongly enough so that large sheets can be lifted and moved around without coming apart. With the addition of a flat tip, V-tip and strip feeder, the Model HT welder can be used to heat-seal vinyl strip on plasticized vinyl tank linings, etc.

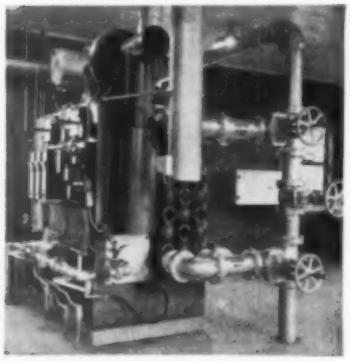
The Kamlar HS model is provided with special high speed tips that hold, feed and guide rod automatically, permitting one-hand operation at speeds up to 50" per minute. The tip cuts rod cleanly at the end of each weld and tests made under actual production conditions proved welds consistently stronger than those made with ordinary hand welders.



This P.F.T.-Pearth Gas Recirculation System mounted on a 70' P.F.T. Floating Cover is part of the new "controlled digestion" system just added to the Decatur, Illinois sewage treatment plant. Design of plant by Warren & Van Praag, Consulting Engineers, Decatur.

Decatur, Illinois installs complete modern P.F.T. "Controlled Digestion" system

Unusual industrial and population growth has called for the modernization and expansion of Decatur's sewage treament plant three times in recent years. Each time Decatur has selected P.F.T. equipment.



Decatur's new P.F.T. No. 750 Gas Fired Heater and Heat Exchanger, with accessory group B, controls, provides full automatic digester temperature control.

The P.F.T. equipment furnished for the most recent expansion is a new digestion system which includes: a 70' P.F.T. Floating Cover with prefabricated aluminum roofing; the P.F.T.-Pearth gas recirculation system and Model 750 Digestion Heater and Heat Exchanger shown; plus a complete new system of gas piping with P.F.T. gas safety equipment.

The P.F.T.-Pearth gas recirculation system includes a gas compressor rated to deliver 150 cfm at 10 psi powered with a 10 hp motor. Controls are provided to automatically discharge to each of 4 peripheral discharge wells in sequence.

The wells are equally spaced around the cover extending to a depth of approximately 10 feet below the liquid level in the tank. The compressor and low and high pressure bypass controls are mounted on the floating cover in an insulated housing.

P.F.T.-Pearth gas recirculation provides the most effective means of controlling scum formations. This allows the use of the full Digester capacity. Combined with close temperature control with a P.F.T. Heater, rapid and complete digestion is assured. Decatur's new "controlled digestion" system is now geared to meet the needs of this fast growing community.

Waste Treatment Equipment Exclusively since 1893

P.F.T.

PACIFIC FLUSH TANK CO.
4241 Ravenswood Avenue
Chicago 13, Illinois

PORT CHESTER, N. Y. • SAN MATEO, CALIF. • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

New Bulletins *AVAILABLE FREE*

Fluid-Tite Sewer Coupling

615

Keasbey & Mattison Co., Ambler, Pa., has just published a 4-page brochure featuring detailed drawings of the Fluid-Tite gasket in the company's asbestos-cement sewer pipe coupling.

In addition to these diagrams, illustrating the coupling's resistance to infiltration, the pamphlet also describes the rigid tests to which the coupling was subjected. According to the pamphlet one of these tests consists of subjecting the coupling and rings to an external water pressure of 25 psi for 24 hrs, without showing any sign of infiltration.

Refresher Course on Water Treatment

616

The Permutit Co., New York, N. Y,. has just released a new 12-page "Outline of Modern Water Treatment Equipment." It is recommended for students, engineers, city officials and others who need a basic "refresher course" on treatment of municipal, industrial and boiler-feed water.

The bulletin lists water impurities and methods of treatment, illustrates typical treatment systems and describes aerators, deaerators, precipitation equipment, filters and ion exchange equipment. It tells how each piece operates and gives its advantages, limitations, range of flow rates, etc.

Diaphragm Feeder Handles Concentrated Chemicals

617

Proportioneers, Inc., a division of B-I-F Industries, Inc., Providence, R. I., has just issued a bulletin describing a compact, redesigned version of the economical wall-mounted Proportioneer Diaphragm Feeder. The new bulletin features explanatory text, photographs, and dimensional drawings indicating that this streamlined unit retains the tested advantages of the former model while taking up less than half the space.

According to the bulletin the feeder pumps directly from carboys, drums, and other shipping containers without dangerous transfer to storage units, and is unaffected by most corrosive chemicals. Pumping rates, from 0.8 to 8.0 gallons per day are adjusted by varying the length and frequency of the stroke. Accuracy is held within plus or minus 5% over a 5 to 1 range.

Sewer Pipe

618

Armco Drainage & Metal Products, Inc., Middletown, Ohio, has just published a new 4-page folder that describes Smooth-Flo sewer pipe, a corrugated metal pipe paved to the full periphery of the pipe.

The folder discusses high flow capacity, flexible strength, durability, economical installation, and wide size range.

Buyers' Guide for Control Equipment

619

Automatic Control Co., St. Paul, Minn., has just published an all-new, comprehensive guide to the selection of the proper controls for automatically controlling liquids at predetermined levels or pressures in domestic, municipal, industrial, or military applications.

The guide features simplified, intergrated, interwired electrical control systems for starting, stopping, and alternating pumps, motors, and compressors, either on-side or remotely for reservoirs, elevated tanks, pumps, and tankless systems.

All systems, including telemetering, are clearly illustrated through use of over 90 photographs and sketches. The book contains explanations regarding functioning of the units, where they are most advantageously located, and how they are best applied.

A 24-page price list gives complete pricing and ordering information in addition to typical wiring diagrams of all of the units.

CONTINUED ON PAGE 27A

switch to
Anthrafilt
Trade Mark Reg. U.S. Pat. off.
THE MODERN ALL-PURPOSE
FILTERING MEDIUM
Best for All Types of Filters
ANTHRAFILT
offers important advantages over sand and quarts
DOUBLES length of filter runs.
REQUIRES only half as much wash water.
KEEPS filters in service over longer periods.
INCREASES filter output with better quality effluent.
GIVES better support to synthetic resins.
PROVIDES better removal of fibrous materials, bacteria, micro-organic matter, taste, order, etc.
IDEAL for industrial acid and alkaline solutions.
EFFECTIVE filtration from entire bed.
LESS coating, caking or balling with mud, lime, iron or manganese.
Write for further information, test samples and quotations to:
PALMER FILTER EQUIPMENT CO.
P. O. Box 1696—822 E. 8th St., Erie, Pa.
Representing
ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Bldg.,
Wilkes-Barre, Pa.

ENSLOW
STABILITY INDICATOR

For checking the equilibrium of a finished water, and supplying an index useful in controlling anti-corrosion treatment. Catalog No. 83-895
WRITE:
Phipps & Bird, Inc.
P. O. Box 2V Richmond 5, Va.

Hoisington, Kansas, Water Works

TRIMS OPERATING COSTS WITH AUTOMATION

with Foxboro

TELETAX Telemetering

as first step

Foxboro Panel for TELETAX Control of isolated booster pumps is located at main treatment plant of Hoisington, Kansas Water Works. TELETAX Receiver (left) indicates and records storage tank level. Pressure Recorder (right) indicates and records clear-water level. Push buttons and acknowledgement lights are below instruments. *Consulting Engineers: Wilson & Co., Salina, Kansas.*

When you're operating booster pump installations out in the middle of nowhere, transportation costs for personnel can run mighty high. Hoisington, Kansas had that problem until they installed Foxboro TELETAX Telemetering. Now with TELETAX making the 14-mile round trip *electrically*, operators can stay at the main plant and turn the pumps on and off by push button. With TELETAX automatically tied in with other plant control functions, the resulting integrated system is expected to save almost $4000 yearly in operating expenses!

Here's what this modern control system will do — automatically: clearly indicate, record, and regulate level of clearwells and storage tanks; prevent pump operation whenever clearwells are dry or full; alert the operators immediately if line breaks; provide safe, unattended operation round-the-clock during peak demand periods.

Investigate the money-saving, efficiency-boosting advantages of Foxboro Automatic Control for *your* operation. Write for information. **The Foxboro Company, 896 Neponset Ave., Foxboro, Mass., U.S.A.**

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

FOXBORO

REG. U.S. PAT OFF.

TELETAX

TELEMETERING

New Bulletins

CONTINUED FROM PAGE 25A

Sewage Measurement Unit

620

Burgess-Manning's Penn Instruments Div., Philadelphia, Pa., has just published a comprehensive bulletin Type "ML" Meter. A new concept in measuring sewage flow through Parshall Flumes.

The comprehensive coverage of the bulletin includes sections on the operation, construction, installation, special features and advantages of the two basic parts of the ML unit—the transmitter and receiver. A capacity table is also provided and the booklet is liberally illustrated with photographs and line drawings.

Cleaning Electric Motors

621

Fine Organics, Inc., New York, N. Y., has available an informative bulletin on "The Cleaning of Electric Motors." The bulletin covers such subjects as: Procedures for Cleaning Motors and Generators, Hazards Present When Using Solvents, How to Select a Safe, Efficient Solvent.

The bulletin describes the solvent F.O.-128 as a cleaning and degreasing agent for electric motors, power generators, condensers, starters, contact points, as well as for mechanical and metal parts, bearings, and finely finished surfaces. It can be used as a dip or spray.

Low and High Head Mixed Flow Pumps

622

Economy Pump Div., C. H. Wheeler Mfg. Co., Philadelphia, Pa., has just published a new six-page two-color catalog, describing Low- and high-head mixed flow volute pumps for sewage disposal, drainage, flood control, irrigation, raw water pumping, or for any relatively clear liquids.

Design and construction details for horizontal and vertical mixed flow volute pumps are presented. Units are built in 12" through 72" sizes, and in 3,000 to 150,000 gpm capacities. Heads up to 180 ft.

CONTINUED ON PAGE 103A

Engineering PLUS...

Keeps Tank Interiors Corrosion Free at a Practical Cost

One of the five municipal tanks serving the City of Jacksonville, Fla. which has been cathodically protected by E.R.P. system since 1942.

The City of Jacksonville, Fla. has relied on engineering plus from Electro Rust-Proofing Corp. since 1942 to protect water storage tanks serving the city. Since installation of cathodic protection, tanks have been virtually corrosion free on the under water surfaces and maintenance costs have been reduced to a minimum.

E.R.P. engineering plus means cathodic protection systems
designed to meet your needs...
maintained to your benefit...
priced to your profit...

E.R.P. provides engineering plus to meet any corrosion problem of submerged or buried metals. For full information on cathodic protection for your water storage tanks, water treatment structures and pipelines, write for bulletin E-42.

E.R.P. CATHODIC PROTECTION SINCE 1935

ELECTRO RUST-PROOFING CORP.
A SUBSIDIARY OF WALLACE & TIERNAN INC.
30 MAIN STREET, BELLEVILLE 9, NEW JERSEY
CABLE: ELECTRO, NEWARK, N. J.

W&T DRY CHEMICAL FEEDERS

For Accurate Feeding Of Water Treatment Chemicals

Full line of wide range dry chemical feeders capable of controlling a few ounces to 3000 lbs. per minute.

Write for Bulletin M-38 for complete Dry Feeder information.

WALLACE & TIERNAN INCORPORATED
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

won't

"RECKON WE'LL HAFTA CUT YORE WHISKERS LOOSE, PAW... THESE TYTON JOINTS IS TIGHTER'N GRAN'MAW'S CORSET."

U.S. cast iron PIPE

FOR WATER, SEWERAGE AND

let go!

Grandpaw's whiskers are proof! Tyton Joint® pipe seals permanently and bottle-tight.

It's easy to assemble, too. A specially designed rubber gasket fits into the bell of the receiving pipe. When the connecting pipe slides into place the gasket is compressed and presto!...a perfect fit! No bell holes, no caulking, no nuts or bolts to fasten. Even green crews look expert in handling it. Tyton Joint pipe doesn't mind the weather, either. You can lay it in rain or a wet trench when you have to.

Call or write today and get *all* the facts about Tyton Joint pipe. Facts that can save you money, time and trouble.

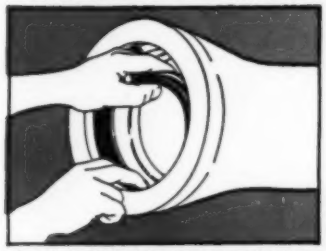
U. S. PIPE AND FOUNDRY COMPANY
General Office: Birmingham 2, Alabama

A WHOLLY INTEGRATED PRODUCER FROM MINES AND BLAST FURNACES TO FINISHED PIPE

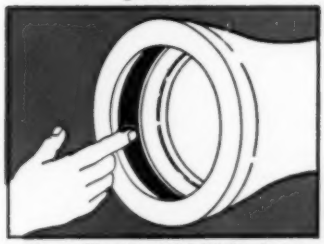
INDUSTRIAL SERVICE CAST IRON

TYTON JOINT

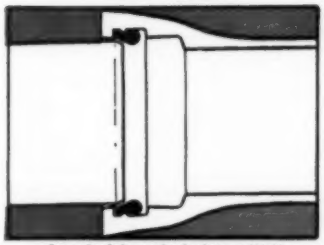
ONLY FOUR SIMPLE ACTIONS



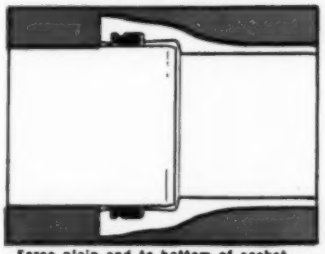
Insert gasket with groove over bead in gasket seat



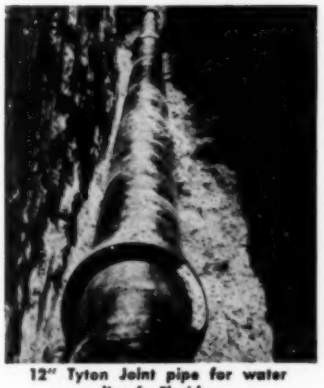
Wipe a film of special lubricant over inside of gasket



Insert plain end of pipe until it contacts gasket



Force plain end to bottom of socket... the job's done!



12" Tyton Joint pipe for water line in Florida

2 ways to lay prestressed concrete steel cylinder pipe

Here in Bossier City, La., the Yor-Wic Construction Co. of Shreveport is using two methods to install a 16 and 20-inch water line. At left the backhoe has dug the trench, lowered the 16-foot length of pipe, and is now shoving it home. In the picture above, where lightweight equipment was advisable, a tractor mounted backhoe has dug the trench, and a truck-mounted crane handles the pipe. The easy-to-make steel-and-rubber joint, and the extraordinary strength of this type pipe made both methods fast.

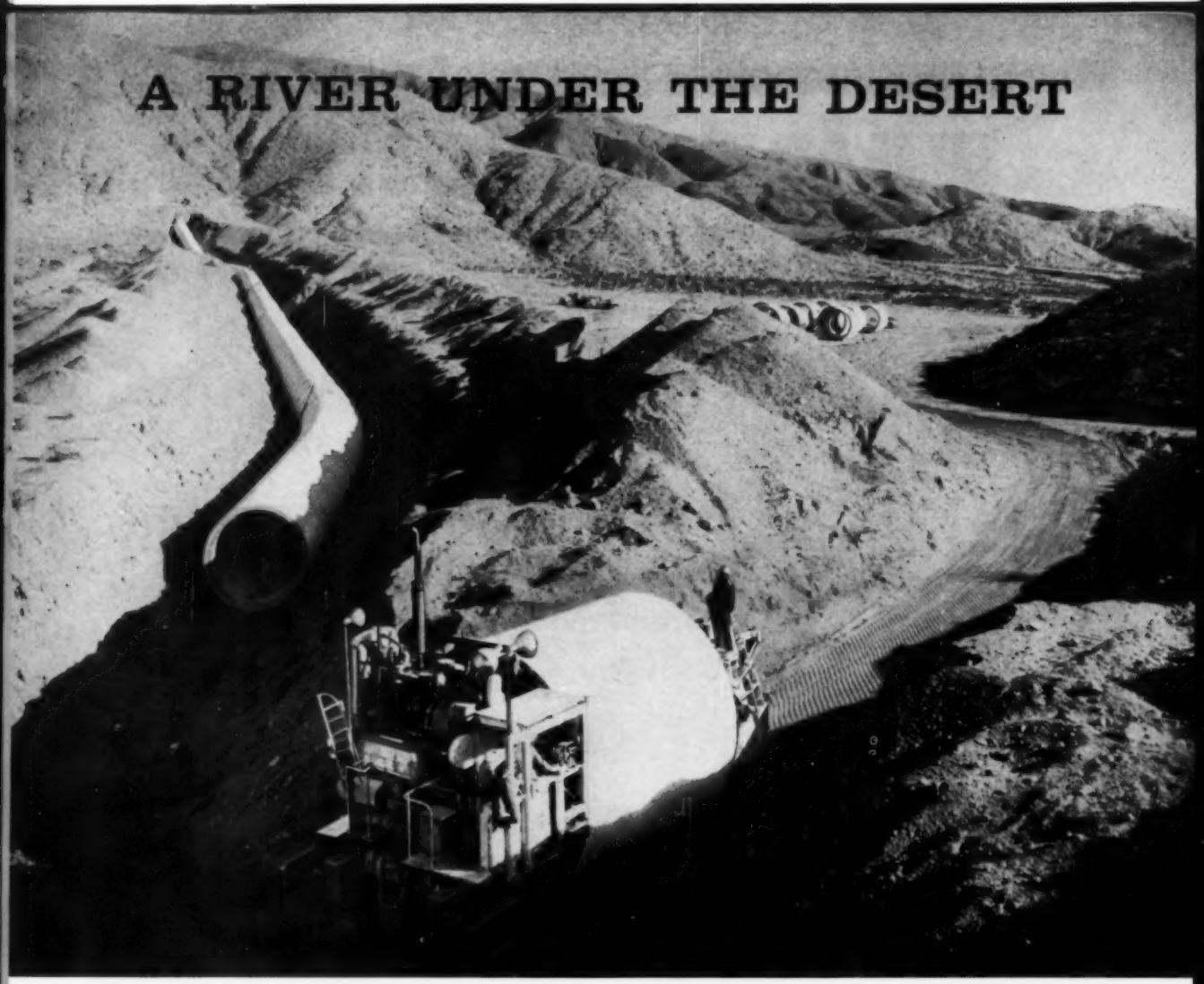
You can't see the reason for this pipe's strength because it is completely encased in concrete. Inside is a leakproof steel cylinder wrapped with high-tensile steel wire. It not only makes this pipe safe to handle, but gives it tremendous resistance to the effect of traffic loads, shifting soil, and sudden internal pressures. It is just about the longest-lasting and toughest all-around pipe you can get.

The high strength and long life advantages of this pipe offer the same benefit for Bossier City's new 16-inch sewer force main. Contractor for the sewer line is P & S Construction Co. of Shreveport. Engineers for both lines are Demopulos and Ferguson of Shreveport. Resident engineer is Donald Downs.

Pipe was manufactured by Price Brothers Company with headquarters plants in Hattiesburg, Miss. for the South and Dayton, Ohio for the North.

Price Brothers

A RIVER UNDER THE DESERT



American Pipe and Construction Co. is engaged in the manufacture and installation of 63,000 ft. of reinforced concrete pipe for 47 inverted siphons of the Colorado River Aqueduct. The siphons, widely spaced along a 183-mile segment of the aqueduct, are part of the program of the Metropolitan Water District of Southern California to bring the gigantic water supply line to full planned delivery capacity of over a billion gallons of water per day.

American's solutions to the remote location and magnitude of the project include the establishment of two on-the-project manufacturing plants. Hauling of 13 ft. 6 in. diameter 68-ton sections of pipe is being accomplished with specially designed 99 ft. trailer-rigs. Approximately 180 miles of access roads are to be constructed before the job is completed in December, 1958. American designed and built the machine shown above to meet special installation problems posed by trenches 125 ft. wide and 50 ft. deep, with slopes up to 50%. This unique "Pipe-mobile" actually carries and installs the pipe.

Today, American Pipe and Construction Co. is more than ever capable of handling problems involved in long-distance transmission of large volumes of water. Fifty years of experience and extensive production facilities are available to help solve any water supply or transmission problem.

American
PIPE AND CONSTRUCTION CO.

Los Angeles: 4635 Firestone Blvd., South Gate, Calif.
LOrain 4-2511
Hayward: P. O. Box 630—JEfferson 7-2072
San Diego: P. O. Box 13—CYpress 6-6166
Phoenix: 2025 South 7th St.—ALpine 2-1413
Portland: 518 N. E. Columbia Blvd.—BUtler 5-2531

Project plants, such as this one located near Desert Hot Springs, California, incorporate all essential manufacturing operations of permanent plants and bring greater economy and coordination to such large projects.

CONCRETE PIPE FOR MAIN WATER SUPPLY LINES, STORM AND SANITARY SEWERS, SUBAQUEOUS LINES

WHATEVER THE SITE

Chicago, Ill.—Installing 24" Mechanical Joint cast iron pipe for water line rerouted due to construction of underground garage beneath Michigan Avenue.

Hickory, N. C.—High beam strength of Cast Iron Pipe makes it particularly adaptable to this type of construction on outfall sewer.

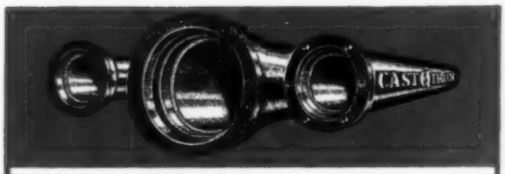
MODERNIZED cast iron

OR SITUATION...

there's a Cast Iron Pipe for the job

WHAT'S YOUR PROBLEM?

let us help you solve it...



6 reasons why Cast Iron Pipe is #1 choice of U. S. A.

1. **HIGH FLOW CAPACITY...** Cement lined cast iron pipe and fittings will not tuberculate . . . delivers a full flow for the life of the pipe.
2. **LONG LIFE...** 42 North American cities are still using cast iron water mains laid 100 years and more ago. Hundreds more have passed the 50 year mark.
3. **BEAM STRENGTH...** Cast Iron Pipe is inherently tough . . . stands up under heavy traffic load, soil displacement and disturbance.
4. **EXTERNAL LOAD RESISTANCE...** 6" Class 150 Pipe withstands a crushing load of 17,900 pounds per foot . . . nearly 9 tons.
5. **CORROSION RESISTANCE...** Cast Iron Pipe effectively resists corrosion . . . vital factor in its long life and dependability.
6. **TIGHT JOINTS...** A full range of leak-proof, low cost, easy-to-assemble joints for pipe and fittings are available for all conditions.

No telling where you may need to lay pipe . . .

Hilly country or flat, city street or rural lane, under superhighways, railroads or rivers.

But whatever the site or situation you *can* be sure of this: with cast iron pipe properly installed there'll be no trouble on or after the job.

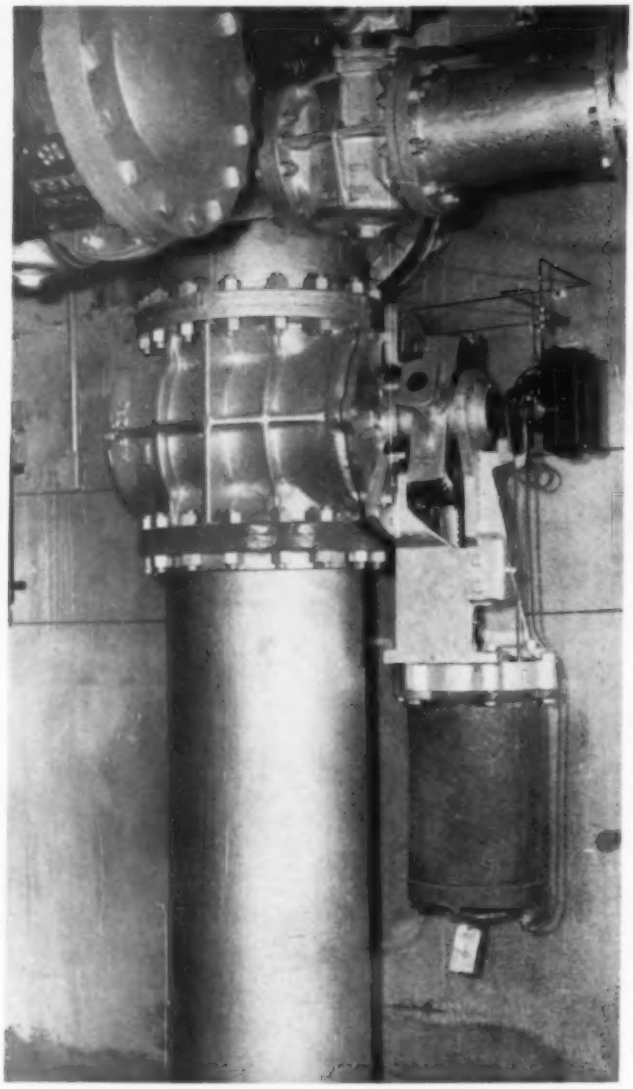
Dependability, long life are built into every rugged length of cast iron pipe. Dependability *proved*, not merely promised.

THE MAN WHO CHOOSES CAST IRON PIPE TODAY WON'T PAY FOR IT AGAIN TOMORROW!

CAST IRON

Cast Iron Pipe Research Association
Thos. F. Wolfe, Managing Director
Suite 3440, Prudential Plaza, Chicago 1, Ill.

pipe FOR MODERN WATER WORKS



What do you want in a control valve?

Precise Control?

DeZurik Control Valves have excellent throttling characteristics. They respond instantly, without cycling; they hold positively—without drifting!

Tight Shut-off?

The rubber-faced plug of a DeZurik Control Valve shuts absolutely tight on any water or sewage plant service—even with sand, silt or grit in the flow—without damage to the seating surfaces—without constant lubrication!

Compact Installation?

The cylinder operator on DeZurik Control Valves is mounted parallel to the pipe—it does not project at right angles to interfere with other installations.

Rugged Construction?

The cast bronze cylinder of DeZurik Control Valves, the stainless steel piston rod, the "O" ring seal on the piston . . . all are designed to deliver longer life with minimum maintenance under any conditions.

And there's more! DeZurik Control Valves with positioners permit cleaner, more simple control console installation; a ¼" copper air line in place of large hydraulic piping which sweats and rusts —a single control knob in place of a 4-way valve. And, despite the obvious advantages, the cost is *low!!*

FREE! Write for your copy of this booklet describing the modern Water Treatment Plant in St. Cloud, Minnesota. Produced for the municipality, it tells in pictures and diagrams the colorful story of the new treatment facilities.

DeZurik Control Valves are available in sizes thru 20", and a full range of materials. Ask the DeZurik representative in your area for more information, or write

DeZURIK CORPORATION
SARTELL, MINNESOTA

OLIVER

MODEL 80 HYDRO-TRENCHER

Rough ripping or ticklish digging

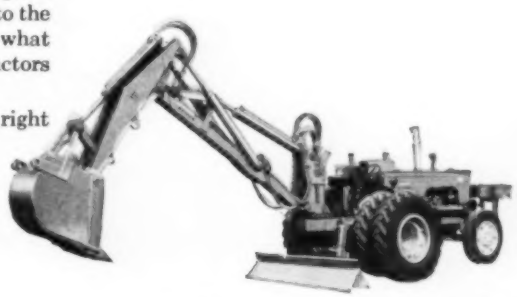
It's all the same to this versatile one-man rig, ready to handle all kinds of excavating and trenching assignments.

Powerful hydraulic pressures give you the ability to rip out pavements or to dig through the toughest soils, even frozen ground. Yet controls are so accurate and sensitive that you can "feel" your way in difficult spots to avoid damage to existing pipes, work close to foundations, etc., with maximum speed and safety.

With its amazing job-ability, the Model 80 Hydro-Trencher gives you rubber-tire mobility to travel anywhere on busy streets, get to the job in a hurry and work fast, achieving lower costs. That's what makes it a real favorite with municipalities, utilities and contractors alike.

Your dependable Oliver distributor will gladly demonstrate right on your own job. Call him today. Or write for literature.

OLIVER Model 80 Hydro-Trencher—available with gas or diesel power, six forward speeds to meet every need for travel and power. Dual hydraulic controls permit raising or lowering bucket while swinging to give you a fast digging cycle. Here's bigger production than you'll get with ordinary equipment of this type.

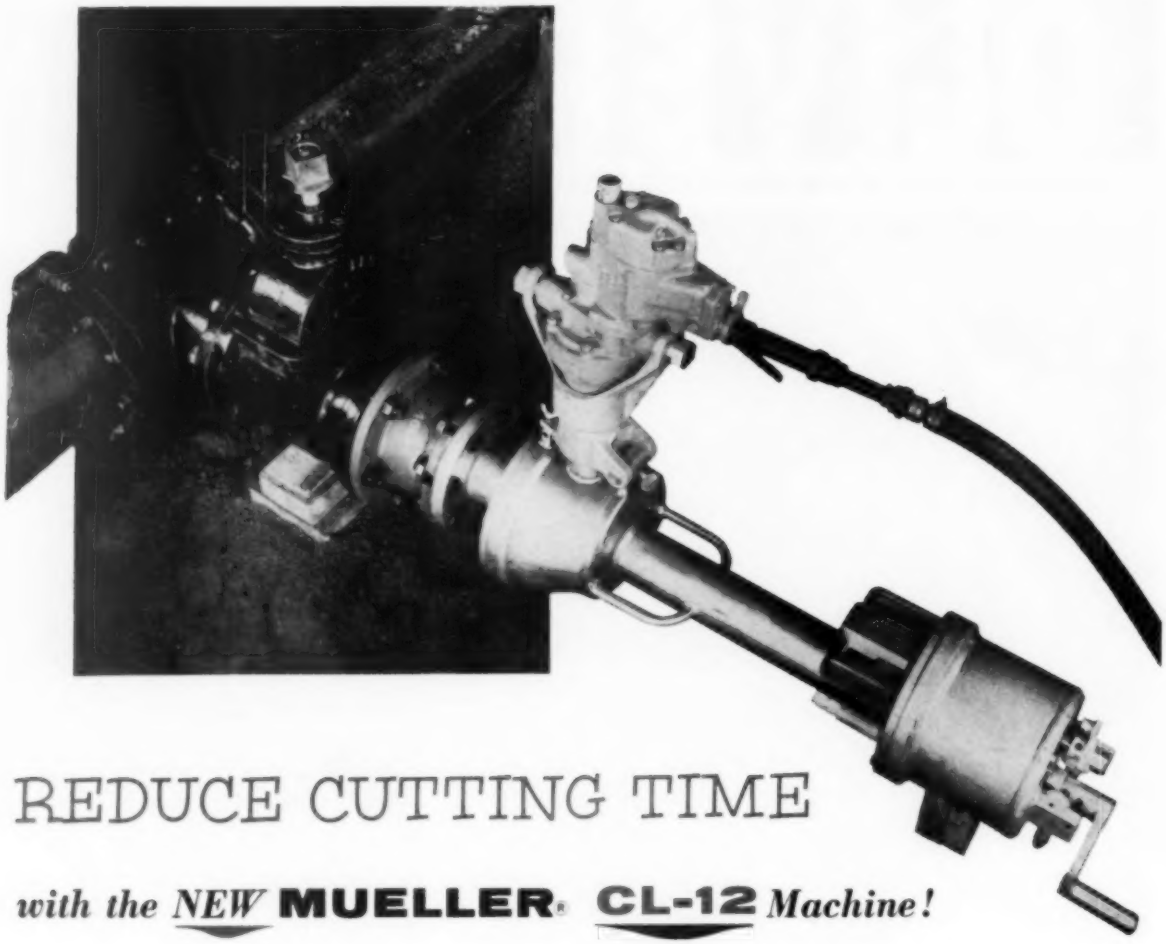


OLIVER

THE OLIVER CORPORATION

Industrial Division, 19300 Euclid Ave., Cleveland 17, Ohio

a complete line of industrial wheel and crawler tractors and matched allied equipment



REDUCE CUTTING TIME

with the NEW MUELLER CL-12 *Machine!*

■ Now — Mueller Co. has developed a fast, automatic drilling machine for making cuts from 2″ through 12″.

The new CL-12 Machine may be hand operated with a ratchet handle or power operated with the Mueller H-601 Air Motor or H-602 Gasoline Engine Drive Unit. No changes in the machine are needed to use either method of operation.

New design and new features also reduce set-up time. Automatic power cutting completely frees the operator for other work around the job-site. *Total on-the-job time is drastically cut!*

Write today or contact your Mueller Representative for full details on the new Mueller CL-12 Machine.

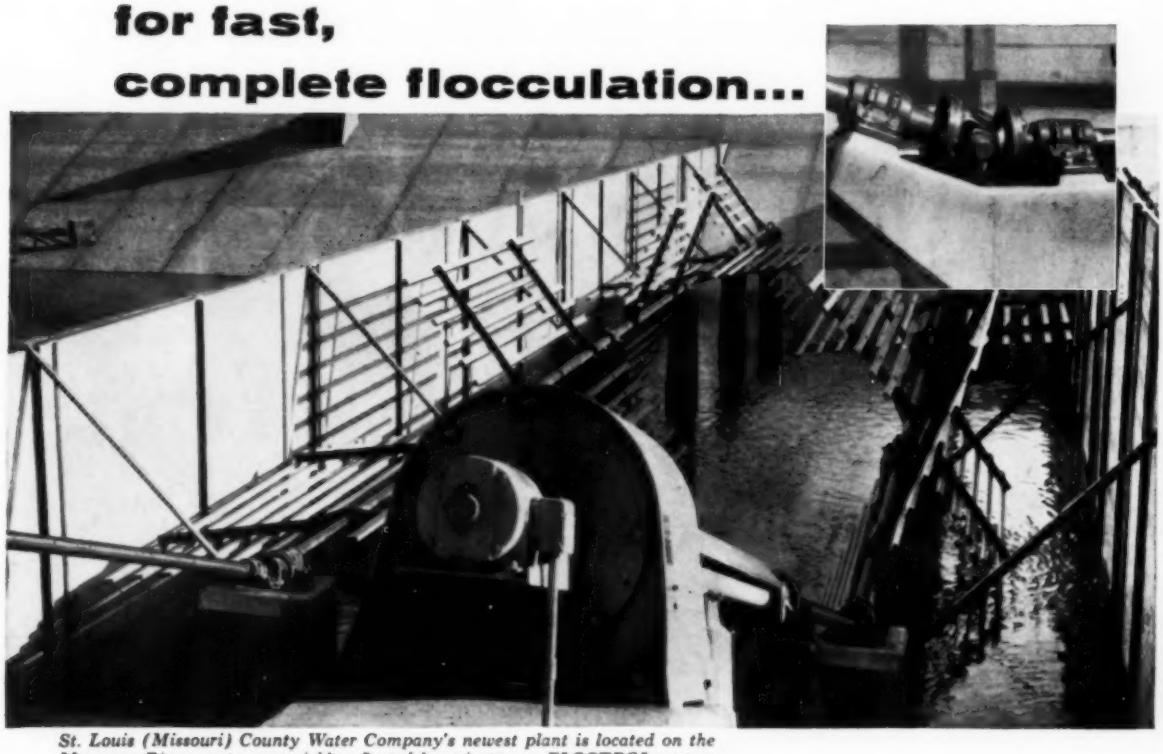
MUELLER CO. Since 1857 SERVING the Water and Gas Industries

MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

FLOCTROL®

for fast, complete flocculation...



St. Louis (Missouri) County Water Company's newest plant is located on the Meramac River, a stream quickly affected by rainstorms FLOCTROL system provides fast, thorough, lower-cost clarification in this efficient 15 mgd. plant

minimum chemical dosage, 30% smaller basins

Jeffrey FLOCTROL systems clarify water, sewage and industrial wastes efficiently and at lower cost:

PROVEN DESIGN—Decreasing rates of agitation and increasing time periods as flocculation progresses insure fast, thorough diffusion of chemicals and complete coagulation.

SINGLE MECHANISM—Rapid and slow mixing are both done with one mechanism, reducing initial and operating costs.

EASY ADJUSTMENT—Rates of agitation are adjusted simply by changing number and arrangement of paddle blades or speed of rotation.

SMALLER BASINS—30% smaller flocculation basins made possible by stationary and rotating baffles, which allow minimum short-circuiting. Settling basin capacities reduced 30% by quicker settling floc.

Jeffrey FLOCTROLS are available in standard horizontal type . . . special horizontal type for use where rapid mixing takes place in a separate basin . . . vertical type for smaller locations where indicated. Catalog 905 describes these and other Jeffrey equipment for water, sewage and industrial waste treatment. The Jeffrey Manufacturing Company, 996 North Fourth Street, Columbus 16, Ohio.

CONVEYING • PROCESSING • MINING EQUIPMENT...
TRANSMISSION MACHINERY...CONTRACT MANUFACTURING

JEFFREY

The more difficult your sewage odor or treatment problems the more startling and definite the proof...

Cloroben is at least TWICE as effective as other products

states authoritative Millburn, New Jersey report, appearing in April, 1958 issue of Public Works.

Well worth your attention is the complete Millburn history, typical of the reports sent us by professional sanitation engineers and sewage treatment plant operators.

Located along the Watchung Hills in Union County, Millburn is a fine suburban community. When vile sewage odors began to permeate the area in 1953, the residents demanded relief. During the summer of 1954 CLOROBEN was first introduced into the sewage collection system, and immediately stopped odor complaints. The CLOROBEN treatment was continued through 1954 and 1955 with excellent results. All odors were effectively controlled in lift stations, force mains and low gradient sewer lines.

Then, in 1956, various emulsifiable chlorinated benzenes were offered the township. Advertising claims indicated these products were almost identical to CLOROBEN. In price they compared favorably. So, in 1956 competitive bids were required, specifying CLOROBEN or equal. And, the contract was awarded to the lowest bidder.

Right after the change from CLOROBEN to the cheaper substitute, odor complaints began coming in. The amount of the chlorinated benzene used was doubled, then quadrupled. Everything else possible was done. Low gradient lines were flushed periodically, and lift station wet-wells cleaned weekly. But, the odor complaints persisted and increased. Sulphides and pH determinations were made throughout the system. Odorous areas invariably showed sulphides at 0.3 ppm or more, with pH below 7.5. The situation got even worse right up to July 31, 1957, when use of the cheap chlorobenzene substitute was stopped. On the following day CLOROBEN was reinstated.

Results were startling. By mid-afternoon sulphides had been reduced 50%, pH was back to 7.5. By evening sulphides in lift stations decreased by as much as 80%. And, no further odor complaints have been received since! Concrete and positive proof of the superiority of CLOROBEN in controlling odors and suppressing sulphide formations in sewage!

To effectively control odors and suppress sulphide formation, no product of its kind compares to CLOROBEN in safety, efficiency, and economy. And, only up-sewer treatment with CLOROBEN provides a non-septic, stabilized influent at the treatment plant for efficient operation.

Remember, CLOROBEN is an exclusive formula, the only chemical product of its kind. So, specify CLOROBEN. Not CLOROBEN or equal.

Because CLOROBEN has no equal.

Yours on Request: Authoritative Technical Bulletin, describing CLOROBEN applications in up-sewer treatment, sewage treatment plant, septic tanks, cesspools, chemical toilets, and industrial wastes. Write "CLOROBEN" on postcard or letterhead for your copy, sent you promptly without cost. Write Dept. WS-6.

CLOROBEN CHEMICAL CORPORATION

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And with good reason: This is the only system available that permits flash drying or incineration, separately or together, in any proportion.

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How to select the best filter rate controller

Unless you check these 7 vital points, you won't be sure you're getting the controller that meets all your requirements

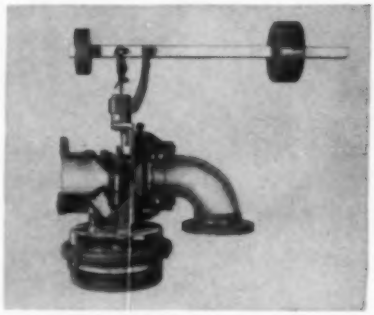
All controllers claim to fill your major requirements:

(1) hold flow at desired rate

(2) operate over wide ranges with low error

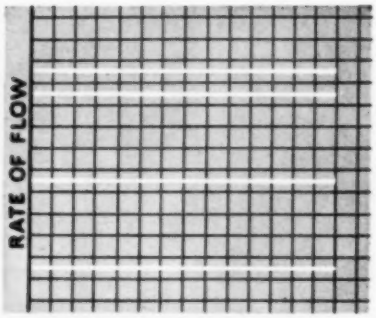
(3) maintain rate *automatically*

But the vital features outlined here determine whether or not you have selected the one type that gives you complete filter control.



1. DIRECT ACTING

Some controllers require pneumatic or electric positioners to hold the desired rate. When power fails, filters run away. But all power can fail and the direct-acting Simplex Type S Controller (cutaway above) still keeps rate uniform.

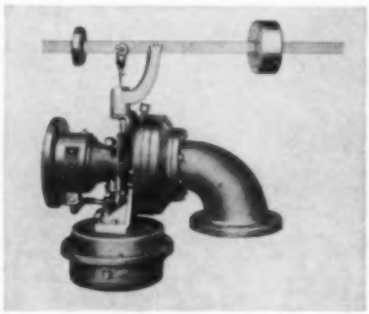


2. ACCURACY TO END POINT

Getting the longest filter run requires the most critical accuracy near the end point. That's where other controllers fail by fluctuating widely. For comparison, see above straight-line accuracy of Simplex Type S Controller.

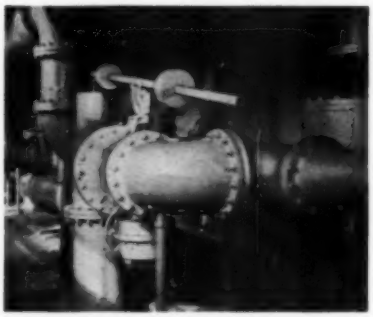
3. PRESSURE LOSS

In other controllers, plates and seats obstruct flow. Above cutaway view of Simplex Controller shows absence of obstructions. Its patented guillotine valve provides the full-line opening that gives you low pressure-loss (under 1' at maximum flow).



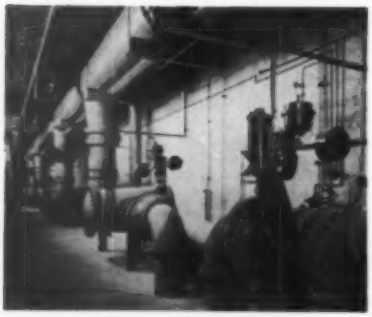
4. TOTAL INSTALLED COST

Other controllers require expensive extras: straight pipe ahead of, or after, the unit; special pneumatic or electric positioners; additional wiring. In contrast, the Simplex Type S Controller is a complete, self-contained unit.



5. SPACE REQUIREMENTS

Controllers that require straight pipe runs waste valuable space, add greatly to plant cost. But, Simplex Type S Controllers are only 3 pipe diameters long, fit anywhere, horizontally or vertically, and eliminate hidden cost of straight pipe runs.



6. MAINTENANCE COST

If used as controllers, ordinary valves require additional positioners—pneumatic or electric. Results: more moving parts; more wear; greater maintenance costs. Simplex Type S Controller is self-contained, operates without these extras, requires virtually no maintenance.

7. PROVEN PERFORMANCE

To help you select the best controller, check with the men who run filter plants. Ask for their experience. Map above shows a few Simplex installations. For others near you—with up to 25 years' successful performance, please write us.

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IN SHARON, PA. *

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• SPEED PIPE-LAYING • MAKE WATER-TIGHT JOINTS

on Shenango Freeway Sewer Project

This sewer line in Sharon, Pa., won't have to be "dug up" in a few years to repair leaky or failing joints . . . despite the *tough* pipe-laying conditions apparent in the photo above. In specifying TYLOX Rubber Gaskets, engineers took advantage of a coupling material *known* for its ageless qualities . . . for its ability to make sewerage and drainage pipe joints leak-proof and root-proof for the life of the pipe itself.

But more than that, along with the certainty of getting water-tight pipe joints, their TYLOX specification assured faster pipe-laying and therefore *lower* job costs . . . Flexible TYLOX is quickly assembled to the pipe, and permits fast assembly of the line. It compensates for pipe angularities, permits wet-trench jointing and immediate backfilling. TYLOX, in fact, is the *one* pipe joint that meets all requirements of engineers, sanitary officials and construction men alike. Specify TYLOX on *your* pipe jobs.

*

PROJECT: Sharon, Pa., sanitary sewer along approach to Shenango Freeway.

ENGINEERS: Chester Engineers, Consultants, Pittsburgh, Pa.

CONTRACTOR: Joe David & Son, West Middlesex, Pa.

PIPE: 21" reinforced Concrete TYLOX-Coupled Pipe, manufactured at Erie, Pa., plant of The Concrete Pipe Company of Ohio, Inc.

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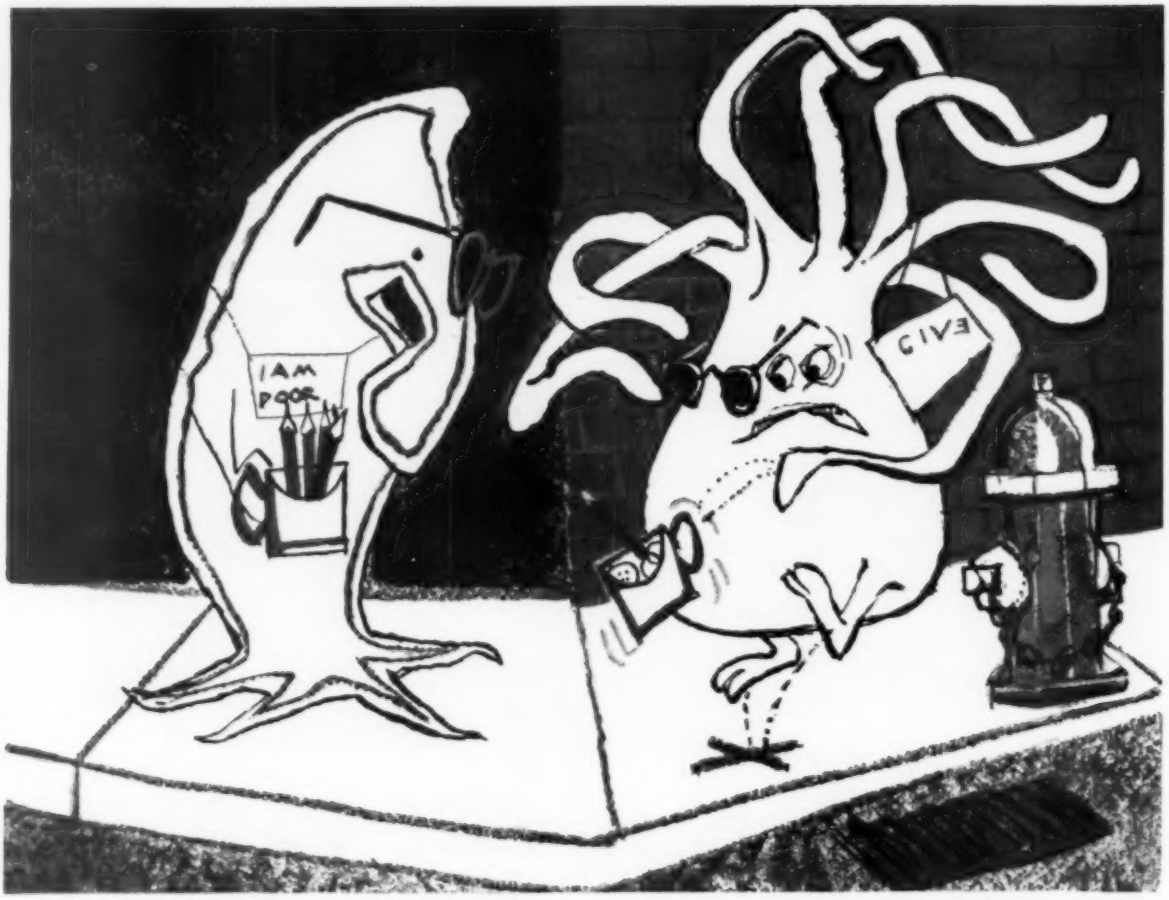

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There's another advantage to using Pittabs and Pittchlor that you'll want to know. These uniform, high quality chemicals retain stability wonderfully well both at work and in storage. This is extremely important, because chlorine must be present in effective strength at all times to neutralize bacteria as they are introduced into the water supply or sewage system.

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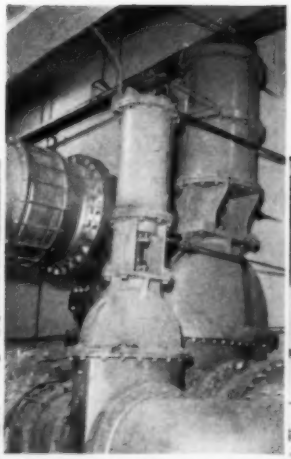
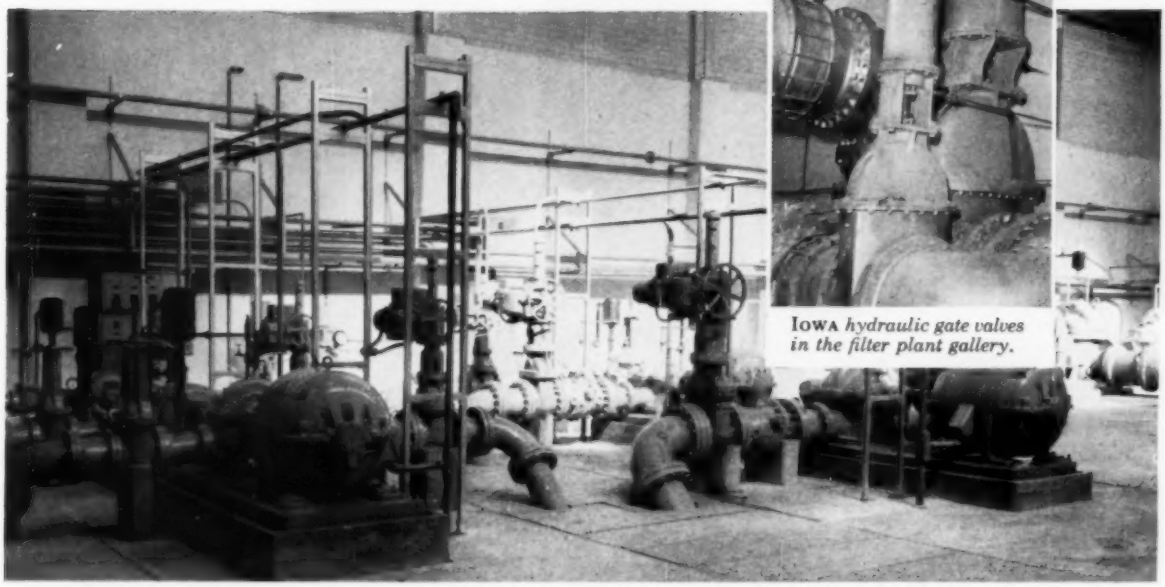


IOWA *hydraulic gate valves in the filter plant gallery.*



IOWA *motor-operated gate valves installed in the main pump station of North Texas Municipal Water District. (General Manager: Mr. A. P. Rollins; Consulting Engineers: Forrest and Cotton; Design Engineer: Mr. Ormond A. Stone.)*

Control delivery of
20 million gallons of water a day
for the North Texas Municipal Water District

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The Filter Plant, located at Wylie, Texas, has a capacity of 20 million gallons a day. However, the design is such that it can operate safely at twice this amount. Water is delivered to the ten member municipalities and the City of Dallas through 90 miles of transmission line, ranging from 12 to 42 inches in diameter.

This Texas application is typical of the ability of IOWA to furnish gate valves to meet the most exacting specifications for plant and distribution service. Be sure and check the wide variety of IOWA valves, accessories and specialties before you place your order.

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will it meet *1988* standards?

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Take a look at the *past* 30 years. Think how much you're saving *this* year on Trident meters installed back in 1928 . . . or even 30 years before that.

Under Trident's strict policy of interchangeability, all improved parts are designed to fit old Tridents too. These up-to-date Trident parts embody every thoroughly tested advancement known to metering science. Not only is repairing easy and economical, but also you actually modernize your Tridents as you go.

This has been a rigid Neptune policy for 60 years. *Every design improvement now on our drawing boards will continue it.* It's your best assurance that the Tridents you buy today will stay modern, earning maximum revenue for your water system . . . at lowest cost . . . for many years to come.

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TRIDENT WATER METERS

Vol. 105, No. 6 · June, 1958

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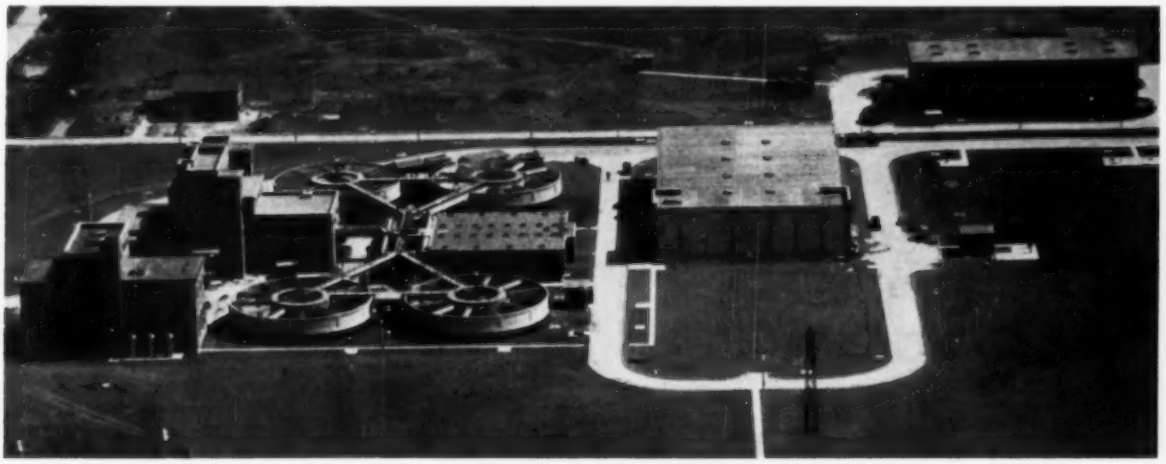
WATER & SEWAGE WORKS



Water Treatment Plant at Hanningfield, Essex, England, serves one million people of suburban London from a . . .

New British Reservoir, *a joint venture*

by WILLIAM A. HEATH, Technical Writer, London, Eng.

RESUMÉ: The need for increased water supply in Essex County, England led to a joint venture of two water companies in the construction of a 6 mil gal reservoir and water treatment plant. This article describes both the construction features of the reservoir dam and the treatment plant components which provide for lime softening with activated silica coagulant aid, recarbonation and filtration.

■ MIGRATION OF POPULATION from nearby London and increasing growth of industry along the north bank of the River Thames threatened to overload water supplies in the southern half of the county of Essex, England, during the years that followed World War II. In 1950 the two water undertakings serving the area—the South Essex Waterworks Company and the Southend Waterworks Company—decided to share their resources and construct a $14½ million reservoir and treatment plant at Hanningfield.

Work on this project was completed in the Fall of 1957 ahead of schedule and now a million people living in the district, long known as "waterless Essex," are being supplied from the 6-mg capacity reservoir. Ultimate yield is expected to total 21½ mgd.

Dam and Reservoir

The reservoir is sited on London clay, along the axis of a small river, Sandon Brook. No difficulty was presented in securing a watertight cutoff, but the problems of building the 6,850-ft long embankment in a comparatively short time called for detailed investigation by soil mechanics.

Construction commenced with the excavating of a cutoff trench along the centerline of the embankment top. Maximum depth of the trench below ground level was 32 ft 4 in. and average depth 22 ft 3 in. Core of the embankment in and above the cutoff trench was filled with puddled clay and a rolled clay fill was used between this and the main gravel fill on either side. Gravel for the main fill was trucked from pits 4 to 10 miles distant along narrow country roads and one-way traffic control was imposed to ensure that there were no hitches during transportation.

The finished embankment contains 1,186,000 cu yd of fill and reaches a height of 64½ ft. A road diversion

is carried on the embankment, which is 25 ft wide at the top and a maximum of 440 ft wide at the bottom.

The reservoir's capacity is 5,968 mg, with a maximum depth of 55 ft and an average depth of 25.16 ft. Top water area is 874 acres and water perimeter measures 5.85 miles.

A small subsidiary reservoir is located on the southwestern edge and water entering this from the catchment area is pumped into the main reservoir.

River Intakes and Pumps

Water supplies are taken from the Chelmer and Blackwater Rivers. From the Blackwater pumping station 27 mgd can be sent along the 9-mile 48-in. diameter steel main to Hanningfield. Provision for pumping facilities on the Chelmer will increase this supply to 35 mgd.

On the Blackwater four vertical-spindle pump sets are in operation. Two have a capacity of 7 to 8¼ mgd each, according to head variation, pump rating being 4,860 gpm against 280-ft head and motor rating of 490 hp at 986 rpm. The other two sets give 3.5 to 4.12 mgd at 280-ft head and 247-hp rating at 988 rpm.

At the river intake there is a coarse filter; a finer self-cleaning screen is located separately near the pumping station.

The 48-in. main to the reservoir includes three chlorinators working on time-control to give chlorine doses at predetermined intervals, enabling growth build-up to be checked.

Water enters the reservoir via an inlet channel at the southeast end of the embankment.

RESERVOIR EMBANKMENT is 6,850 ft long, 64.5 ft high, 440 ft wide at the base and 25 ft wide at the top. A road is carried on the embankment. Capacity of the reservoir is 16 mil gal.

Outlet Towers

To avoid rush of incoming water, an outlet tower is located half-way upstream from the embankment on the northwest side of the reservoir.

The valve tower on the embankment has facilities for drawing off water at three levels into a screening chamber below. Two short overflow weirs and an overflow chamber adjoining the valve tower can discharge water through a tunnel in the embankment into a stilling basin and thence to the stream below the dam.

Water also can be drawn off at the outlet tower and passed to the valve tower through a 48-in. diameter concrete pipe laid under the reservoir bed.

The northwest perimeter is protected against wave action by a concrete slope which separates two sludge lagoons from the reservoir; weirs are provided to permit clear effluent to overflow back into the reservoir.

Outlet Pumps

From the valve tower a 42-in. diameter steel pipe takes water to a pump station. The four pumps are of variable-speed, inclined propeller type, with one acting as a stand-by.

Each pump has a capacity of 5 to 10 mgd, with head varying from 5 to 40 ft, depending on reservoir level. Pump speed range is 470 to 1,072 rpm and horsepower rating is 13 to 130.

Power for the pump motors is from two 250-kva transformers, giving operating voltage of 440; speed variation is by induction regulators and remote and local control facilities are provided.

The pumps send water to a supply chamber through a 42-in. diameter main. From the supply chamber it flows under gravity to the treatment plant.

A constant head in the treatment plant is assured because pumping rate is regulated to give a slight overflow back to the reservoir from the supply chamber over a measuring weir.

Softening and Clarification

Softening to the required hardness (not exceeding 150 ppm) is carried out in the treatment plant using lime and soda ash.

All chemicals other than lime are received in bags. Bulk lime is discharged at ground level into the chute of a crushing plant and crushed lime

is raised by elevator into storage bunkers.

Dispensing is by dry feed machine. After mixing with water, application to raw water taken from the supply chamber to a group of four 65-ft diameter Accelators is made by dosing gear. Flow to the Accelators is controlled by a butterfly valve and measured by a 36-in. venturi meter.

Softening is supplemented by coagulation with collodial silica, produced by the partial neutralization of the alkali in sodium silicate by sodium bicarbonate and then applied to the Accelators. Alumina can be applied to the whole of the raw water flow or to individual Accelators.

The Accelators are of the upward-flow, sludge-blanket type, each with a capacity of 250,000 gal. Water in the primary Accelator zone is chemically treated and a circulating mass of precipitate forms. A motor-driven impeller draws the water into the secondary zone, whence it overflows to the slurry zone where separation takes place. The clarified water rises and flows into an annular channel; concentrated sludge is drawn off from a collecting compartment and flows by gravity to a sludge recovery pumphouse.

Recarbonation and Filtration

A contact tank receives the softened, clarified water; here excess alkalinity is removed by bubbling in carbon dioxide through tubular bubblers to bring the pH down to 8.0. The carbon dioxide is produced by burning metallurgical coke in automatically-fired boilers, waste heat being utilized to help lime slaking.

After passing the contact tank the water is delivered to eight rapid gravity filters, each having a filtration area of 864 sq ft and capable of handling water at the rate of 72 gph per square foot. Total capacity of the eight filters is 12 mgd and the design allows for the construction of eight additional filters in the future.

The filters are washed by first loosening the sand by means of compressed air delivered at 300 cfm from two impeller-type blowers. An upward wash of water is then applied at some 7,000 gpm.

All operations are under push-button and lever-arm control and visual indication and chart records are given at control positions to show rate-of-flow and loss-of-head condition as each filter comes due for cleaning.

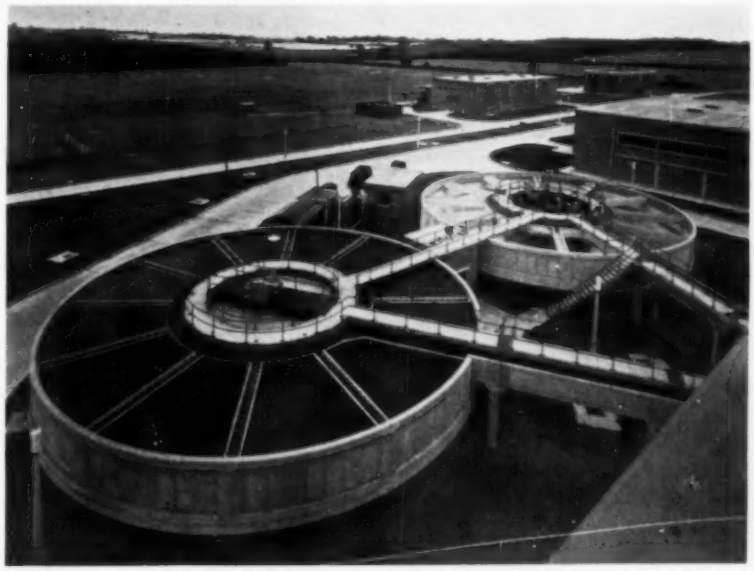
INCLINED PROPELLER PUMPS, of which there are four, pump raw water to the treatment plant supply chamber.

Distribution Pumps

The two washwater pumps used are of the trunk-slung, vertical-spindle type, having a capacity of 8,500 gpm each at 35-ft head; drive for these pumps is by a 115-hp electric motor operating at 875 rpm.

From the filters a 27-in. diameter pipe takes water to a gauge house, which contains sample pumps and automatic gear for controlling chlorination, and thence to a two-section 2-mg clear water reservoir.

Daily requirements are fed into outgoing pipelines by six vertical-spindle centrifugal pumps. Three pumps supply the Southend Company's mains at 2 to 3.6 mgd each against 80- to 120-ft. head; motor speed of these pumps is 800 to 1,120 rpm at 45 to 115 brake hp. The other three pumps supply the South Essex Company's pipelines.



SOFTENING and clarification are carried on in four upflow "Accelator" clarifiers, each 65 ft in diameter with a capacity of 250,000 gal.

PUMPING STATION operations are centralized in this control station on main floor of building housing six vertical-shaft high pressure centrifugal pumps.

They deliver 2.5 to 4.08 mgd against 164- to 194-ft. head, motor speed being 950 to 1,200 rpm at 110 to 210 brake hp. The Southend Company's supplies are pumped to a reservoir 1½ miles distant, the South Essex Company's water going via a 30-in. diameter aqueduct to 34-in. and 36-in. mains over a mile away from the reservoir.

The main electrical distribution switch-gear is housed in this pumping station; incoming power is at 11,000 v ac. Transformers reduce the voltage to 415. Two 750-kva transformers power the motors of the pumps sending water out to the two companies' districts.

Administrative buildings include office accommodation, an automatic telephone exchange, and storage. To accommodate staff, 20 new houses were built near the reservoir.

Colorful New Building Home of Badger Meter

The Badger Meter Manufacturing Company's new Brown Deer Office Quarters are best described as colorful yet functional.

Located near Milwaukee's new planned express highway system, the new building is a two-story, 42,000 sq ft structure that cost approximately one million dollars. The new administration building sets back some 75 yards from the highway, behind an artificial lake, on a 56-acre site at 4545 West Brown Deer Road. A horseshoe-shaped drive leads up the entrance with visitors' parking areas on each side of the entrance. At night, flood lights under the water in the lake, blanket the lake with color. The lake is as functional as it is attractive. The 2⅓ million gallons of water are aerated by the fountain and used in the heating and ventilating system. The lake water is also utilized for fire protection and meter testing.

LAKE and west visitor's parking area of the new Brown Deer Office Building.

Inside, the visitor finds an open, two-story high reception area lined on one side by floor to ceiling picture windows, and on another by a mural stretching across the second floor balcony. The mural, depicting Badger Meters in use, is the work of Edmund Lewandowski. The ground floor level includes the reception area, and facilities for accounting, tabulating personnel, purchasing, engineering, research and development, and cafeteria.

In the lower level is a large lounge and recreation area reserved for employee relaxation, units for heating and ventilating, and storage space.

Generous use of colors and with veneer paneling add to the modern decor. Even filing cabinets are finished in bright combinations of yellow, blues, reds, browns and white. Each executive office has individual picture windows and color motif along with lightweight wood panel desks. All areas of the building are fire protected by an automatic sprinkler system. The building is completely air conditioned.

Comments on inspection periods, repainting schedules, cathodic protection and general techniques of . . .

Water tank maintenance

with suggestions for the improvement of these practices

by D. W. CHRISTOFFERSON, Engineering Department, Chicago Bridge & Iron Company, Chicago, Illinois

■ ALTHOUGH it is a known fact that any municipality or industrial company which invests thousands of dollars in a modern water tank should be concerned with taking good care of it through regular inspection and painting, there are many municipalities that fail to inspect and repaint (especially on the inside of the tank) as frequently as they should for their own benefit. Generally speaking, industrial companies are more likely to follow adequate maintenance procedures.

It is with this thought in mind, that the following comments on present practice and recommendations for improvement are offered.

Inspection Period

Most water tank users admit that regular inspection is necessary, but these inspection intervals range from 6 months to 5 or 6 years. The general trend, however, is for a yearly inspection that is sometimes complete, covering both the interior of the tank and all exterior surfaces.

Recommendation

One inspection every year, plus a thorough, complete inspection at least every 3 years. This recommendation should be followed even though the environment may be benign and the structures are single continuous unbroken surfaces without rods, struts, and such. The important surfaces are the interior surfaces.

Also, check around anchor bolts to see if any corrosion has started there, and replace any mortar that has worked out from beneath the base plate. A careful check of the foundation for cracks or movement is a wise precaution. The expansion joint and heating facilities in the base should be checked for leakage.

Painting Schedule

Even though many municipalities inspect the tanks regularly, less than half of them keep regular painting schedules. The author's experience indicates, that all too many who paint regularly outside, sorely neglect the inside of the tank. In general the most common regular repaint interval is 4 years. Some follow 2 and 3 year schedules, especially where tanks are located in industrial fume or seaside areas, or where problem waters are stored.

Recommendation

Repainting at least every 5 to 6 years is normally required—and oftener if the annual inspection indicates a more frequent schedule. The important thing is to use the inspection data, not just to file it.

Tank interiors usually require painting more often than exteriors. With the commonly used types of

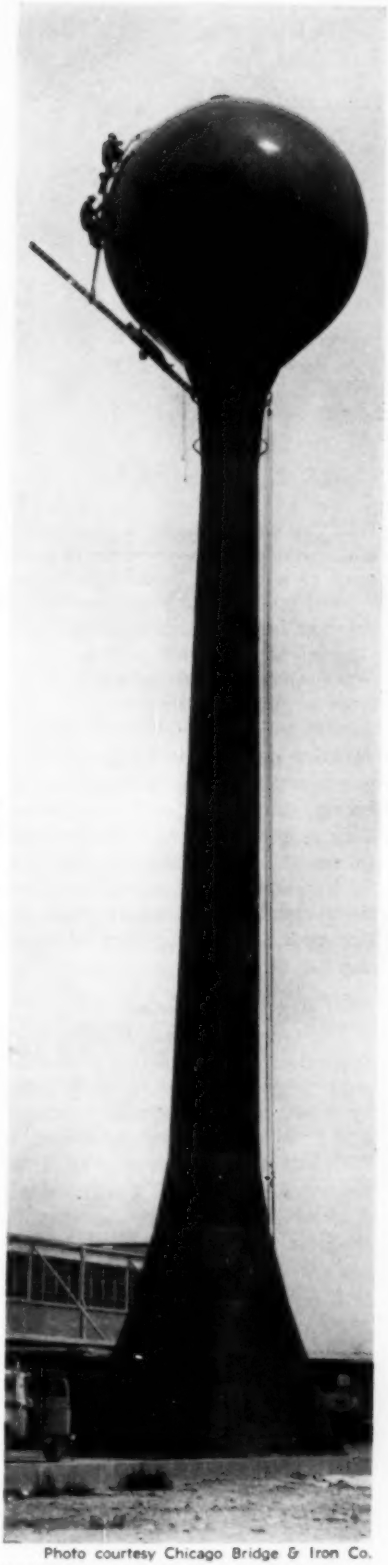


Photo courtesy Chicago Bridge & Iron Co.

PAINTERS employ a unique ladder rigging to surface of sphere. Block and tackle on right of center column support bosun's chair for painting column.

Photo courtesy Chicago Bridge & Iron Co.

THE OLD AND THE NEW. New style tanks overcome the ungainly appearance of a straight "standpipe" type.

paint at least some interior painting is required at 2 to 5 year intervals. Some quality paints properly used, however, may last 10 years. In cold-weather areas, ice forming on interior surfaces may pull or scrape off those paints which tend to lose adhesion or become brittle at low temperatures. This is particularly so in municipal service where no heat is provided. Such municipalities depend on continual circulation of water through the storage tank to avoid excessive freezing.

Paint and Its Application

The types of paint and methods of application vary widely. The most popular procedure is to apply paint by brush. Some use spray application, a few roll the paint on. Aluminum is the most popular for exterior finish coats. Red lead or zinc chromate paints are normally used for priming the base steel. Red lead paints alone are commonly used on interior surfaces. Other popular inside maintenance finishes are asphalt and wax-grease type coatings. A number of people favor phenolic or vinyl base paints for inside work, while others use hot and cold applied coal tars.

Recommendation

In general, follow American Water Works Association specifications.

Considering all the problems involved in interior water tank painting, red lead linseed oil type paint (Federal Specification TT-P-86a, Type I) is normally used on new tanks and is generally recommended as appropriate for repainting in many instances. Two complete coats are usually adequate. This type of paint dries slowly, and although thorough cleaning is always recommended, it need not be as precise as with the faster drying paints. Litharge is normally added just before application to improve drying and hardening. Even so, at least one week of drying under good conditions, after the final coat, is recommended before admitting water to the tank. The longer the drying period the more assurance of satisfactory service.

Phenolic paints dry faster and can be given consideration for the interior where the cleaning is extremely thorough, but due to the faster drying, intercoat adhesion is a problem and must be given special consideration. On repainting, sandblast cleaning is often required, whereas on new tanks, the manufacturers standard pickling process provides excellent surface preparation for shop priming with phenolics, as well as other types of paint. Among the phenolic paints, the zinc dust-zinc oxide types show promise and are being used in increasing amounts. Typical are paints similar to or conforming to government specifications MIL-P-15145, TT-P-641, Type III or Corps of Engineers Formula P-5.

Vinyl and hot coal tar paints are expensive and generally require the best of surface preparation as well as expert application; however, good results have been reported on interior surfaces. This is especially so with hot coal tar applications in the warmer climates. Experience is still somewhat limited with the vinyls.

For priming exterior surfaces, good results can be expected with red lead similar or equal to that set forth by Federal Specification TT-P-86a, Type I or Type II. Type I can be recommended for use over all types of cleaning that may be employed. Type II dries faster and harder, gives excellent results and is often preferable where the cleaning has been thorough and the time between coats is limited, or where the iron oxide color is desirable.

For exterior final coats, satisfactory results can be expected with most reputable manufacturers' products designed for this service. For aluminum in normal exposures, a ready-mixed paint is recommended which incorporates 2 lb of aluminum paste to 1 gallon of long oil varnish. Aluminum paste shall conform to Federal Specification TT-A-468a, Type II, Class B, and the mixing varnish to Federal Specification TT-V-816, Type II, Class B. Excellent results have been obtained with a cumaroneindene resin China wood and refined soya bean oil varnish meeting this specification. For colored finishes, the long oil alkayd materials are highly recommended for the normal exposures. With aluminum or colored finishes, two coats over primer are recommended.

Painting Contractors

Most owners, both industrial firms and municipalities, employ outside painting contractors. In view of the fact that costs vary so much in different parts of the country, no logical average can be applied. Tank conditions, necessary preparation, kind of paint, method of application, and number of coats, all affect the over-all cost and make direct comparisons worthless.

Recommendation

Use reliable contractors with tank experience and sufficient equipment, so that no part of the job is slighted.

Cathodic Protection

It has been the author's experience that the majority of industrial firms owning tanks protect the interiors of their tanks below the water line by installing cathodic protection equipment. But fewer municipalities employ cathodic protection. Perhaps this is because industry, using stored water primarily for fire protection, seldom can or prefer not to let the tank empty. Anode materials include carbon, aluminum and magesium.

Recommendation

Inspect your cathodic installation at regular intervals to make sure that anode rods are all in place and have not shorted out. Maintain current settings at values recommended by the manufacturer of the equipment. Even though cathodic protection is used it is necessary to maintain the area above the water line, and where it fluctuates, by painting. Repainting recommendations for below water line should be made by the manufacturer of the cath-

odic equipment—so many are the special technical factors involved.

Heating Facilities

Maintenance of heating facilities among industrial firms usually consists of annual cleaning of the heat exchanger, plus checking of steam traps, cleaning of trap strainers, and routine pipe repairs.

Recommendation

A municipality, to prevent freezing, should arrange its pumping schedule to draw the water level in the tank down during the day and to fill the tank at night. This procedure adds heat to the tank since water from the ground is well above freezing; about 60 F in the south, 55 F in the central states, and 45 F in more northern areas. The further north the tank location, the greater the daily drawdown should be—at least one-half and sometimes more during prolonged cold spells even if it means wasting some water. Actually a controlled ice layer on the tank walls reduce tank capacity and heat loss so that the required drawdown is more easily accomplished. One of the most critical situations is a northern location with a lake as the water source. The lake water may not be much above freezing and thus require a great amount of circulation or supplemental heating.

Any pumping schedule should be such that the water being pumped flows through the tank rather than directly to distribution mains.

The pipe riser in either a heated or unheated tank should be insulated. Inspect this insulation regularly for breaks.

If there is no drawdown, as would be the case in water storage by an industrial firm for fire protection, heat must be added. The two methods are (1) a separate steam heat exchanger and (2) a direct hot water boiler—in the base of the pedestal. In either case the cold water supply is drawn from the foot elbow of the outlet pipe and discharged into the tank by a separate insulated heater pipe.

Inspect heating equipment at the end of each heating season to determine whether scale has formed. Put heaters into operation before freezing weather is due to arrive. Caution: Make sure that all valves are open for free water circulation. As an added precaution, have someone climb to the top of the tank to determine whether the water is being heated. Water at the tank surface would be measurably warmer than that in the cold water supply to the heater.

Miscellaneous Maintenance

Most industrial firms and municipalities landscape the grounds around their storage tanks with lawn, shrubbery, and trees to make them as attractive as possible. In residential neighborhoods, this attention to the beauty of the community is especially valuable. A well landscaped, attractive setting for a tank can add to surrounding-property values.

Photo courtesy Chicago Bridge & Iron Co.

TANKS can be decoratively utilized in municipal parks.

Many ingenious and practical uses have been developed for the housed area represented by the base of the pedestal. Obviously it saves construction of separate structures to house the heating equipment, and conveniently contains and protects the piping and fittings essential to the water distribution system. In addition, tools, gardening equipment, fire hose, chemicals, bricks, spare parts, pumping equipment, and even work benches and test equipment are conveniently locked up and sheltered in the conical foot of many water tanks.

Pickup's from Purdue "Sanitary Engineering News"

Don E. Bloodgood, Editor

The seasonal field studies by the U. S. Public Health Service of the Dakota lagoons proved that raw sewage stabilization ponds are "a practical minimum-cost method of raw sewage treatment in the Northern Plains region of the United States."

Some fifteen to twenty species of mosquitoes commonly associated with the development and utilization of water resources in the United States are of public health importance because of their ability to transmit disease or because of their vicious biting habits.

About 2000 times as much radiation is required to kill a bacterial spore as is fatal to man.

Sensitive detector crayons for phosgene, hydrogen cyanide, cyanogen chloride and lewisite have been made.

"Sterilization of sewage by irradiation doubtless will some day become economically feasible. Before this day comes, however, the sterilization of drinking water by irradiation will be a reality. Both forms of fluid involve large volumes, but sewage presents the additional problems that go with suspended particulate matter."

—David L. Narver
in Civil Engineering

"The rise of CO_2 content in digester gas above the established normal is the best warning signal of failure yet discovered and usually becomes evident in time to take corrective measures." —Miller and Barron

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Holland, Michigan has switched to Lake Michigan water as well supplies have failed after 110 years of continuous service.

"Studies in which alkyl benzene sulfates are reduced only 45% by biological action showed alkyl sulfates to be reduced 95%. Thus, if all the commercial detergents were composed of alkyl sulfates, they would readily be destroyed by sewage treatment processes." —University of California

Dear Bill: How's your water works psychology working these days?

The other day I dropped in on our friend, Edgar Wallace and he told me about his recent experience in applied water works psychology.

To begin with, it was one of those days when Ed was wondering how in the world he could make a sale from his line of pressure water filters, and put an end to his prolonged business slump. It has been his experience that however bleak the outlook, continued concentration upon the objective would invite a favorable result, usually a lead or order from some totally unexpected source. However, he was on the point of forsaking this philosophy and goofing off to a movie, when one Mr. Charles Sidney entered his office.

As soon as Mr. Sidney had seated his well groomed middle-aged person in the proffered guest chair, he revealed a forthright character by immediately beginning an outline of the reason for his visit.

"I own a group of ten summer cottages at Lake Clearwater, which you no doubt know is located about twenty-five miles north of here. Water is supplied to the tenants through my private distribution system which includes a pump and elevated storage tank.

"This water has for many years been used for drinking purposes, and no harmful effects have ever resulted. In fact this lake helps to feed the reservoir which supplies several towns and villages without filtration, and it is always nice and clear. However, some smart aleck got all excited about seeing a little fish in his bath tub, and has been promoting the idea that the water is not safe, and that I should be forced to put in a filter.

"The idea is silly, but I figure that it will be cheaper to install a filter than to argue about it, so I'll buy one and put it in just for the psychology of the thing."

Edgar asked the necessary questions to determine the required capacity, the operating pressure that the filter would have to withstand, and that the storage capacity was great enough to provide backwash water, should Mr. Sidney be mistaken about there being no dirt in the supply.

A thirty-six inch diameter steel shell pressure unit seemed to fill the bill. Mr. Sidney signed an order, paid cash, and Edgar's slump was ended.

The factory promptly shipped the filter with hookup diagram, and installation and operating instructions. Later Mr. Sidney phoned Edgar that the installation had been made, and requested him to visit the site to determine whether or not everything was according to Hoyle. It was, and more!

A special house had been built for the filter. The wall in front of the operating valves was all glass, so that a full view of the interior was presented. The filter stood upon a white tile floor, and the rest of the interior was handsomely coated with glossy white paint. It gleamed sanitation. For the further edification of viewers, a small glass sided container modeled a sectional view of the filter bed with its sand and supporting layers of gravel.

Edgar had never seen such a pretentious filter installation for a private water supply, and felt that Mr. Sidney was more than deserving the high praise being voiced by the people of the settlement. Congratulating Mr. Sidney upon his magnificent achievement, Edgar left the site tingling with pride for having been a party to so satisfactory a project.

Some three weeks after his inspection visit, Edgar answered his phone to hear Mr. Sidney's anxious voice:

"The filter is having a hemorrhage!"

"Are you kidding, Mr. Sidney—what do you mean hemorrhage?"

"The water comes out blood red."

"What's it like going in?"

"Clear, just like always."

"I'll drive up first thing in the morning and see what goes on."

"Please do," pleaded Mr. Sidney, "the whole settlement is in a turmoil."

Edgar was surprised and perplexed. Red water indicated iron. He possessed a mineral analysis report which showed a trace of iron in solution, but there was no aeration in such a closed system, or other apparent inducement for its visible precipitation.

Edgar then considered the possibility of corrosion, and when to the analysis data he added an educated guess of the temperature, he was able to satisfy the values required by Langelier's formulae, and found that no corrosion should be anticipated. It then occurred to him that this had been a useless effort, because corrosion could not possibly occur at a sufficiently high rate to redden so great a flow rate. The whole thing seemed incredible. "I'll have to see it to believe it," mused he.

And see it he did. Mr. Sidney had not exaggerated. The water entering the filter was indeed clear, but definitely rust colored as it left. Edgar had seen red water going into filters and coming out colorless, but never the reverse.

Because the analytical laboratory and advisory staff of the filter manufacturer were some thousand miles distant, it would require weeks before he could hope to obtain help from that quarter, and the emergency required no worse than an over-night answer. However, by way of buying a little time, and impressing Mr. Sidney with

his scientific approach, Edgar bottled samples of influent and effluent. Placing these in his car, he drove back to his office.

While Edgar had been a number of years in the filter vending business, his applications had been largely on City supplies for the protection of industrial processes against the sediment common to all large distribution systems. Hence, his problems had been so elementary and few, that he had never been awakened to the extent of his ignorance.

In desperation he now turned to the unread literature he had filed away, and scanned through numerous technical papers. He found nothing relevant to his problem until well past midnight when he dusted off a volume titled "Water Supply and Treatment," by the American Water Works Association. There, under the subject of Iron, he was flabbergasted to read that there was such a thing as iron bacteria, the most impotrant of which bore the name of crenothrix and embraced five varieties. These were crenothrix polyspora, leptothrix ochracea, gallionella ferrugines, crenothrix fusca and streptomyces.

That much was for sure, but the rest of the text was not so unequivocal. It contained such words and phrases as "conceivably," "debatable," "complex processes," "is believed to result," and in general left considerable latitude for the reader to do his own guessing. So Edgar bravely mixed fact with fancy, and settled for the following interpretation:

"Crenothrix feeds on dissolved iron, which acts as vitamin enriched food, the consumption of which precipitates the iron." This, reasoned Edgar, would stain their bodies and account for the color. The voids between grains of the ton of sand in the filter bed would provide generous shelter for breeding. Then when he considered the possibility of an astronomical rate of reproduction, it did not seem too farfetched to conclude that he had discovered the reasons for the distressing condition which Mr. Sidney had so aptly described as "hemorrage."

The cure? Well, the book advised removal of the iron from the water so that the Crenothrix would starve to death. An alternate method was disinfection. Copper sulfate or chlorine was recommended for the purpose.

The consideration of disinfection triggered Edgar's realization that he had been top fool in a paradise when he sold the filter in the first place. In his enthusiasm for making a sale, he had conveniently forgotten that pressure filters were notorious bacteria hatcheries, and hence questionable for application on any unsterilized potable supply. This he had known, albeit he had never heard of red bacteria. The thought added greatly to his feeling of responsibility for rescuing Mr. Sidney.

Disinfecting the lake by the usual method of dragging a gunny sack of copper sulfate crystals behind a boat had only one feature to commend it to him. One could troll for fish at the same time. The chance of uniformly applying the proper dose was less than problematical, and the method at best could provide only temporary relief.

Chlorine could be applied at the filter site, and the dead crenothrix filtered out, but this would require a major undertaking. One would have to provide chlorine and coagulant feeders, a mixing chamber and a generous retention basin, all ahead of the filter. Above all, the required operating attendance would have to be of too high an order. All too frustrating indeed, thought Edgar, and then he had an inspiration. Possibly this is only a localized temporary condition that could be rectified by thoroughly sterilizing the filter He would settle for this idea. If it didn't work, he would admit failure, return Mr. Sidney's money, and withdraw from the whole messy deal with the hope that his conscience would heal without too great a scar.

With only a few hours sleep after his session with the midnight oil, Edgar showed up at the filter site with two dozen quarts of household bleach which he had picked up from stores along the way. The labels on the bottles read sodium hypochlorite with active ingredient of five per cent by weight.

He first backwashed the filter. Then he removed the cover from the manhole in its top, dropped the water level enough to provide room for the hypo, all of which he poured in and mixed thoroughly with the water above the bed.

An hour later he drained out enough water to bring the chlorine in contact with all parts of the sand bed and underdrain system.

Three hours later he backwashed the filter, and returned it to service. The effluent ran clear and colorless, and the day, at least, appeared to have been saved.

"Be sure and phone me, Mr. Sidney, if you see any more red water," said Edgar, as he started for home.

Weeks passed into months without further word from Mr. Sidney. Several times it occurred to Edgar to inquire about the situation, but he was reluctant to kick a sleeping dog. He came to believe that no news was definite proof of his cleverness in diagnosing and curing a red water case. His ego was further comforted by the ingenuity he had displayed in meeting the emergency with only crude ready-at-hand facilities.

Then one day Mr. Sidney paid Edgar a visit.

"Glad to see you. Sit down and make yourself comfortable," greeted Edgar in his most hospitable manner.

"I've only a few minutes to spare, but finding myself in the building, I felt I'd like to say hello."

"I didn't hear further from you, so assumed that your filter continued to behave itself. No more red water, I take it?"

"Oh yes," answered Mr. Sidney, "a week after your visit it showed up again, but I solved the problem myself."

"How?" asked Edgar, all ears.

"It was simple enough," said Mr. Sidney, extending his hand in departure, "I took a trusted helper with me late one night, and we installed an underground by-pass around the filter. The water don't go through the filter any more, but the tenants don't know it, so the psychology is just as good."

Cordially yours

Clif

Ed. Note: Clif is actually M. P. Robinson, of Upper Montclair, N. J.

How Treatment with Carbon and Chlorine, with Proper Application, Licked the . . .

Taste and Odor Problems *at Valparaiso, Ind.*

As Described by RICHARD COOTE, Superintendent of Water Filtration.

EDITOR'S NOTE: Tastes and odors caused by algae infestation of impounded water supplies are no respecter of the size of the supply. In the author's city, where the water use is less than 2 million gallons a day, the problem is just as real as in any community using ten or a hundred times as much. In Valparaiso, Ind., the solution of the problem required foresight, understanding, ingenuity, plant improvements and close laboratory control of activated carbon and chlorine dosages. Operating data for taste and odor periods in 1957 are included in the article along with a review of the problems and their solution.

■ TASTES AND ODORS have constituted a major problem at the Valparaiso, Indiana, water treatment plant for several years. Chief among the causes of the trouble have been the turnover periods of the supply lake and the algae growths in this same reservoir.

Source of Supply

The main supply is taken from a small lake of 80-acre area and a drainage area of about 2.8 square miles. Rainfall is the only source of replenishment, as there are no springs in the lake. During periods of heavy rainfall the water is very turbid and contains high concentrations of organic matter, algae, and all types of foreign matter from the runoff.

Increasing demand on this small lake, combined with evaporation, has required that during very dry periods well water be pumped into the lake from deep wells, the amount increasing yearly with the increased demand. For example, in 1956 raw water pumpage was 658.5 million gallons, but 367.9 million gallons of well water were pumped into the lake during the year. The wells were run about 4½ months during the year to help hold the lake level during the dry period.

There are two reasons for not pumping the well water directly into the system. The first is that the well water is hard (26 grains per gallon) and high in iron content (2.0 to 5.0 ppm). By pumping water of this quality into the lake first, only 0 to 0.3 ppm iron is contained in the plant's raw water and the hardness remains under 15 grains per gallon.

The second reason for pumping to the lake is that the water level would drop badly from evaporation alone. It is obvious that the greater demands have made this system of supply limited for future usefulness. Eventually a supplemental supply must be developed to help the present supply: a survey is now under way for an addition to the supply for the near future.

Turnover Periods

In the late fall, and again in February, the lake "turns over" due to temperature changes. During these periods a very objectionable taste is experienced, as the lake has a muck bottom.

Prior to 1949 this effect was even more pronounced. This came about because the intake was very close to the bottom (2-ft riser) and was in about a foot of muck. During the turnover a brown musty-smelling water was pumped into the plant. At times this water had a threshold odor of 40 or better and had a very bitter taste. Small doses of activated carbon would bring the threshold odor down to an acceptable point, but the taste was marked and doses as high as 125 pounds per million gallons were necessary to give a palatable water.

When the new intake was planned in 1948 a raft was anchored near the site and water samples were taken from different depths for a period of two months. Complete analyses were run so as to establish the level at which the best water of uniform quality could be obtained. After completion of the test run the new intake was set with a 12-ft riser. This brought

the port to the depth at which the most uniform water was obtained, most of the time giving a much better quality of raw water easier to treat during the turnover periods, which are now shorter and are more easily handled with smaller carbon doses.

The previously mentioned pumpage from the wells to the reservoir lake has brought about one noticeable result in the last few years of greater demand—the turnover periods are either very mild or are nonexistant.

Algae Problems

The algae problem still is a major one, but it has been made easier to control through improved laboratory testing.

In May 1955 there was a spell of bad taste and odor; the water leaving the plant was not good. However, from this necessity, new feed methods and better laboratory control were worked out. During 1956 and 1957 these conditions have been much improved.

First, laboratory control is more complete. Every month algae counts are made on the raw water during at least one week. These counts are on the number per milliliter and the types of algae. This counting program has been in effect long enough that it now is possible to tell which algae produce the bad odors, and the count at which treatment must begin in order to keep the threshold odor from getting too high. At times the counts change rapidly as to number and types. Therefore, year-round checks provide considerable information for use in taste and odor control.

As an example, during a recent period of poor tastes (November 8-25, 1956) the following results were obtained:

Raw water:

Threshold odor number	10
Taste threshold number	7
Algae count, no./ml	530
Algae types	*Aphanizomenon, Synura, Uroglena*
Temperature, °F	38

Tap water:

Threshold odor number	2
Taste threshold number	2
Carbon dose, lb/mg	65
Taste	None
Odor	Slightly earthy when hot

The October algae counts had been low but by early November the *Aphanizomenon* and *Synura* were increasing. After November 25 the counts again dropped and the raw water threshold odor decreased to 5, which needs no treatment.

Again in April 1957 there were were heavy rains. The turbidity of the raw water was high; color and organic matter increased as runoff from the heavy rains entered the lake, and temperature and chlorine demand increased.

Water Temperature Important

Two streams enter the reservoir (Flint Lake). The overflow is located just behind the filter plant, creating a small body of water there during periods of high lake level. By fall this area is emptied, but in spring this shallow body of water is a good breeding spot for algae when there is no overflow. This is the area where the well pumpage is discharged into the lake, thereby helping to keep the shallow part fresh and cutting the algae mat. Temperatures in this water reach the 90's during the daylight hours.

Temperature of the raw water entering the plant is of great importance in controlling the tastes and odors of the finished water. Because the reservoir is small and shallow, the temperature rises raidly in the spring and does not change until late in the fall.

For example, raw water temperatures are in the high 50's by mid-April, reach the 70's by early June, the high 70's by mid-June, and remain at that level until early October, not dropping below the high 50's until very cold weather in November. At that time the sudden temperature drop causes algae count variations that may cause short periods of taste problems.

Temperature of the water going to the distribution system also presents a problem, because the higher the temperature the more noticeable are the tastes and odors. For example, odors that would not be noticed in a water at 55°F or 60°F are very noticeable in the same water at 70°F, and more so at 75°F.

Several years ago a series of threshold odor and taste tests was run to establish palatable threshold numbers for both characteristics. These tests established that a hot threshold odor

TABLE 1

Summary of Laboratory and Treatment Data During Taste and Odor Periods, 1957

Date	Threshold Raw Hot	Threshold Raw Cold	Threshold Tap Hot	Threshold Tap Cold	Water Temp., °F	lb/mil gal Dosage, Cl_2	lb/mil gal Dosage, C	Algae Count, no./ml	Algae Types
May 5	7[1]	T	4[2]	T	60	40	0	120	Synedra, Asterionella, Anurea
May 16	10[3]	3[3]	7[2]	3	63	45	0	173	Ceratium, Asterionella, Synedra
May 20	15[3]	2[4]	2[4]	1	60	38	56	1,370	Vorticella, Cyclops, Asterionella, Notholca, Microcystis
May 29	9[3]	1	1	0	63	48	42	595	Cyclotella, Cyclops, Synedra, Asterionella
June 8	14[5]	3[1]	7[1]	1	67	45	0	1,400	Cyclops, Peridinium, Vorticella, Synedra, Stephenodiscus
June 9	16[5]	3[6]	3[6]	T	72	35	45	1,450	Cyclops, Peridinium, Vorticella, Synedra, Stephenodiscus
June 17	18[5]	2	4[3]	1	76	35	45	1,800	Dinobryon, Synedra, Anurea, Asterionella, Melosira
June 24	15[5]	2	3[1]	0	76	42	67	1,820	Dinobryon, Synedra, Anurea, Asterionella, Melosira
July 3	14[7]	1	2[1]	0	74	46	71	1,044	Anabaena, Microcystic, Anurea, Pediastrum, Ceratium, Synedra
July 8	8	0	2	0	75	42	62	435	Melosira, Ceratium, Asterionella, Anurea
July 13	3	0	2	0	74	58	0	250	Melosira, Ceratium, Asterionella, Anurea

[1]Musty. [2]Weedy. [3]Sour musty. [4]Faint musty. [5]Fishy. [6]Aromatic. [7]Moldy.

of 5 on the plant tap water was the maximum that could be passed without consumer complaints. Tastewise, the maximum allowable is a threshold of 4. By holding to these values taste and odor conditions are under control, but at high temperatures even lower thresholds are sought to be sure of satisfactory results. Table 1 summarizes the laboratory results and the treatment during taste and odor periods in the spring of 1957.

Continuing Trends

Improved laboratory control has resulted in better taste and odor control. Use of the threshold odor and taste tests permits correlation of these with algae counts as periods of taste and odor develop each year. The longer the records are maintained the easier should control become, as there is always a similar trend; that is, algae increases of certain types occur at about the same time resulting in similar odor periods. With this forewarning, corrective treatment can be initiated before odors can cause consumer complaints.

Application Point Important

Another important factor in taste and odor control is the application point of the chemicals to provide sufficient contact time.

In the Valparaiso plant short settling time was already a factor. With the increasing demand for water the condition became acute. However, carbon could not be used because the short detention time resulted in so much carryover of carbon to the filters that it passed through them whenever the dose was over 15 pounds per million gallons. This caused "black" water in the distribution system—and consumer complaints. When combined with bad taste or odor the situation was serious, as there was no way of producing a palatable water.

Use of chlorine dioxide proved helpful in that it either removed or reduced the odor and taste period to the point that consumer complaints were markedly reduced or entirely eliminated. Although this method of control was expensive at times and did not always give the best results, it was greatly beneficial until plant expansion could be arranged.

Plant Improvements

The plant expansion was completed in 1950. Addition of a 485,000-gallon clarifier in series with the old settling basin provided sufficient settling time to allow use of carbon. Increased mixing time insures better flocculation, with a water of better settling quality entering the clarifier, and a clearer water entering the filters. Better settling has removed much of the foreign matter, thus helping with control of the algae conditions.

Installation of additional filters also helped considerably, as the filtering rate was considerably reduced, thus eliminating carbon passage from the picture.

With these improvements completed, carbon could be used for odor control. It has been found that much better results are obtained with less carbon if the carbon can be applied first and sufficient time allowed for adsorption before breakpoint chlorination is applied.

For the first few years after the plant expansion carbon was added to the raw water basin and chlorine was not added until the middle of the mixing basin (about 15 minutes later in the flow pattern). This proved satisfactory, giving good odor removal with nominal carbon feeds. When no carbon was used the chlorine was added in the raw water basin.

In 1954 no carbon was used, as the raw water was of very good quality. Good settling and breakpoint chlorination sufficed.

In 1955, however, raw water of very bad quality required a return to carbon dosing to insure a palatable final water. The carbon was fed as previously described. However, during the intervening two years consumption had increased greatly and although more carbon was used (14 ppm compared with a previous high of 9 ppm), threshold values were very high.

With the poor results from the carbon, it was decided that the carbon contact time prior to the chlorine feed had been reduced because of the increased flow rate. To increase the flow time between the two application points, the chlorine feed point was moved to the outlet of the new clarifier (actually the inlet of the old settling basin). At peak flow of 3 mgd this gave the carbon a contact period of about 4 hours before the chlorine addition. Carbon dosage was immediately reduced and a palatable water was obtained. Chlorine also could be reduced, thus reducing costs still further.

Since this time, whenever taste and odor conditions arise these changes in chemical application are made, giving maximum advantage of the carbon and chlorine in turning out a good finished product.

One disadvantage encountered in this method of chemical feeding was that algae growths in the clarifier became very heavy. This condition was kept under control, however, by additional chlorine dosing ahead of the clarifier during short periods at night. This did not seem to affect the good quality of the plant effluent, yet it held the algae under control.

Summary

By operating the plant in the manner described, with close plant and laboratory control, it is felt that even under severely adverse raw water conditions a palatable water that will meet with customer approval can be produced. This is a factor that over the years has become a "must."

Since it has become possible to use carbon at all, low dosages remove the bitter or musty tastes and the fairly low (T.O. 6) odors usually encountered in the cold raw water. Thus, these conditions do not create the problem generated by the spring and early summer algae. However, increasing the carbon contact time by moving the point of chlorine application has eliminated this problem as well.

With the overloading of filtration plants due to increased demands, the quality of the finished water is bound to be affected. To meet the requirements of a good finished product all means of obtaining it must be explored. It must be remembered that contact time is very important in water treatment and that overload plants lack this essential element.

To preclude any repetition of the past problem, Valparaiso is currently considering new supply possibilities and planning for future plant expansion while still producing the best product possible.

Until now, there has been little information in the literature about . . .

Algae and Their Effects *on D.O. and B.O.D.*

PART I

by THEODORE F. WISNIEWSKI, Director Committee on Water Pollution, State of Wisconsin, Madison, Wisconsin.

EDITORS NOTE: At the "Seminar on Oxygen Relationships in Streams" held at the Robert A. Taft Sanitary Engineering Center in Cincinnati, Mr. Wisniewski presented a detailed study of algae in the Fox River and their relation to dissolved oxygen and B.O.D. in the river. This is a subject about which little has been known heretofore and yet it appears to be quite important in stream pollution. In hopes that this study and its detailed data will stimulate others to undertake work along those lines and extend our knowledge of this problem, *Water & Sewage Works* is publishing the report in full. Because of the length of the article, it is arbitrarily divided into two parts. In Part I, there is set forth the questions for which answers were sought, techniques used, results of observations on algae counts, and the effects of algae as shown in Tables 1 to 5, and Figures 1 and 2. Part II will contain data Tables 6 and Figures 3, 4 and 5, as well as pertinent discussion.

■ DURING 1955 AND 1956, cooperative state-industry stream studies were conducted jointly by the Wisconsin Committee on Water Pollution and the Sulphite Pulp Manufacturers' Research League, Inc. These studies, conducted with assistance of personnel from pulp and paper mills located on the rivers investigated, were directed toward evaluation of stream loading and purification capacity. Bulletin WP-101 issued March 15, 1956, detailed the results of studies in 1955; Bulletin WP-103 is a detailed report on the studies made in 1956.

As the studies progressed, it became apparent that it would be necessary to evaluate the effect of algae on the purification capacity of a stream. Attempts to evaluate this effect were made in 1956 in conjunction with the cross-section surveys of the Fox River.

The Fox River forms one of the major drainage basins of Wisconsin, the stream and its tributaries draining a total of 6,520 sq mi. The section studied is the lower extremity of the basin from Lake Winnebago to Green Bay, containing 6 per cent of the drainage basin area but having 83 per cent of the total fall.

The rapid descent of the river in the 39-mi stretch studied, plus the vast storage system backed up by dams located at Neenah and Menasha which create a flowage area of 297 sq mi at elevation 750, make available the important water powers found on the lower Fox River. Plentiful water and power has made possible the development of the lower Fox River as it now exists, resulting in the greatest concentration of the pulp and paper industry in the state, as well as population concentration per stream mile. Hydro-electric developments along this section make use of the majority of river fall, creating a series of river run pools utilizing the 166 ft of fall in the 39-mi distance from Neenah-Menasha to Green Bay. The elimination of all fast water reaches has thus reduced opportunity for natural reaeration of the stream, as well as the capacity for purification of wastes.

The U. S. Geological Survey has maintained a river gaging station on the lower Fox River for the past 40 years at Rapid Croche Dam at mile 19.3 on the stream. The station at this point intercepts the drainage from 6,150 sq mi of the drainage area. The duration curves indicate that the stream at this point discharges 1,250 cfs or more 95 per cent of the time. The 50 per cent discharge value is 3,610 cfs.

Sources of pollutional wastes of man-made origin discharged to the stream over the section studied are derived from two major sources. These are wastes, treated and untreated, from the pulp and paper and other industries, and treated sanitary sewage.

Several additional sources of organic and inorganic matter reach the stream and can be expected to have material effect upon the total loading assimilated. These other sources have received little, if any, study or evaluation as to their actual importance in the over-all picture of stream pollution.

The following sources probably have a greater effect on stream conditions than has heretofore been realized:

1. Large tonnages of organic matter produced by algae grown in the "blooms" on upstream lakes and in quiet waters behind dams along the Fox River.

* Abstracted from Evaluation of Stream Loading and Purification Capacity, Supplement No. 1, Committee on Water Pollution Bulletin No. WP 103 by Lueck, B. F., Scott, R. H., Wiley, A. J., and Wisniewski, T. F. (March 1, 1957.

TABLE 1

Algae Counts on Fox River Water

	Organisms, 1,000/l					
	Station A		Station B		Station C	
	7/25	8/8	7/25	8/8	7/25	8/8
(a) Blue-Green Colonies or Filaments						
Anabaena	167.2	1,540.0	100.5	925.0	67.2	700.0
Aphanizomenon	800.1	2,435.0	301.6	590.0	200.2	295.0
Coelosphaerium	7.4	24.6	3.7	16.4	.....	4.1
Gloeotrichia	33.1	258.0	.....	369.5	.....	.....
Lyngbya	7.4	24.5	3.7	37.0	.....	.....
Merismopedia	.....	184.5	335.1	295.0	133.2	410.0
Microcystis	73.8	78.0	29.5	20.5	44.3	24.6
Nodularia	.....	.....	.....	73.6	.....	.....
Unident. single cells	11,500.0	12,244.1	10,320.2	7,125.0	8,640.0	7,433.6
Subtotal	12,589.0	16,698.7	11,094.3	9,452.0	9,084.9	8,867.3
(b) Green Colonies or Filaments						
Ankistrodesmus	.....	.....	.....	37.0	134.1	221.5
Chlamydomonas	.....	.....	.....	.....	200.0	.....
Kirchneriella (?)	.....	.....	1,000.0	406.5	.....	410.0
Oocystis	.....	114.0	14.8	.....	.....	258.5
Pandorina	3.7	.....	.....	8.2	33.1	.....
Pediastrum	.....	8.2	3.7	4.1	7.4	4.1
Scenedesmus	.....	37.0	134.0	73.6	100.0	147.5
Schroederia	100.0	124.0	234.5	37.0	33.1	.....
Unident. single cells	11.1	4.1	72.2	296.5	3.7	143.5
Subtotal	114.8	287.3	72.2	296.5	511.4	1,185.1
(c) Diatoms						
Cyclotella	267.9	438.0	670.1	698.0	841.9	1,249.8
Fragillaria	.....	4.1	.....	8.2	.....	4.1
Melosira	11.1	32.8	81.2	41.0	36.8	41.0
Stephanodiscus	47.9	205.0	92.3	67.3	11.1	73.6
Unidentified	267.9	.....	335.1	.....	236.0	.....
Subtotal	734.8	679.9	1,551.4	814.5	1,144.2	1,368.5
Total	13,438.6	17,665.9	14,094.9	11,129.4	10,740.5	11,420.9
Inert Material	140.0	123.0	372.7	90.3	18.4	37.0

2. Settled organic and inorganic solids derived from fibrous materials, from algal blooms in prior years, from silt deposited by soil erosion, from extensive weed beds, from fungus growths which may be quite heavy in some waters, and from storm water drainage.

3. Drainage from farm lands heavily fertilized with the more concentrated chemical fertilizers common to modern practices in diversified agriculture may also be indirectly important in accelerating growth of algae and increasing their abundance.

The effect of algae in streams is recognized as having some significance, but there is little information available in the literature on these effects. The preliminary planning for this phase of work, therefore, was complicated due to the lack of specific points of departure based on previous work by other investigators. The algal load, in relation to oxidation ponds, has been investigated by the University of California group at Berkeley covering some aspects of the dissolved oxygen balance under controlled experimental conditions and with certain cultures. In studies of biological and chemical aspects of organic waste lagoons by A. F. Bartsch of the Robert A. Taft Sanitary Engineering Center, some attention was given to dissolved oxygen production by algae. Little information was available regarding stream work and algal load in relation to the influence of algae as it either increased or decreased the oxygen demand load while the process of waste stabilization was taking place.

It was early recognized that efforts in this regard needed to be limited to restricted areas of inquiry, and that information gained in the preliminary phases would not be any complete answer to a problem which will require more extensive investigation. The experimental work and conclusions drawn therefrom are not presented, therefore, with any assumption that the problem associated with algal growth and death in the flowing stream is answered; rather, additional questions are posed. Neither is the data without significance, as it may stimulate others to undertake work along this avenue of experimentation and does give several points for additional study if later opportunity permits.

The main questions for which answers were sought by the preliminary experimental work were:

1. What influence, if any, does the presence of algae have on the laboratory BOD determination?
2. What influence, if any, do increasing amounts of algae have on the laboratory BOD value?
3. What difference occurs in oxygen usage rates between samples containing algae which are incubated in the dark and in the light?
4. What influence, if any, does the presence of dead or decomposed algal cells have on the BOD determination?

Considering the foregoing questions, it is apparent that three principal variables are introduced into the normal BOD reaction in attempting to solve these problems. The presence of algae, or experimentally increasing the amounts of algae, supposes that such presence or addition will be reflected in an increasing BOD. It is not reasonable to presume otherwise, considering that added organic matter is thus present to enter into the reaction. However, the presence of algae in the sample incubated in the dark may affect the BOD value in two ways: (a) by direct addition of organic matter capable of aerobic bacterial decomposition, thus adding to the normal BOD; and (b) the respiration of the live cells, thus utilizing the dissolved oxygen in the dilution water, resulting in an added apparent BOD. These two variables, due to the presence of algae, could be effective in increasing the BOD value of any sample incubated without light in the normal manner, each, or both together, contributing to added oxygen usage measurable by the determination. A value is thus obtained consisting of a true BOD due to the stabilization of decomposable organic

TABLE 2

5-Day, 20C BOD on Algae Studies

July 25, 1956							August 8-9, 1956						
	BOD, ppm							BOD, ppm					
Susp. Sol., ppm	Dark Incubation 25% Conc.	Dark Incubation 50% Conc.	Dark Incubation 100% Conc.	Light Incubation 25% Conc.	Light Incubation 50% Conc.	Light Incubation 100% Conc.	Susp. Sol., ppm	Dark Incubation 25% Conc.	Dark Incubation 50% Conc.	Dark Incubation 100% Conc.	Light Incubation 25% Conc.	Light Incubation 50% Conc.	Light Incubation 100% Conc.
STATION A													
0	3.4	2.5	0.9	2.0	1.9	0.4	0	5.0	3.1	1.3	4.2	1.3	0.9
2.4	3.3	2.5	1.0	1.6	0.9	— 2.9	4.1	6.2	4.0	2.4	4.6	0.7	0
4.8	3.9	2.5	1.6	0.2	— 1.2	— 2.5	8.2	5.8	5.0	3.6	— 0.4	— 1.4	— 0.7
11.5	5.3	3.8	2.5	0.4	— 2.8	— 3.0	13.7	8.4	8.6	5.5	4.4	1.7	— 3.7
14.2	4.7	4.3	3.3	— 1.1	— 5.3	— 2.5	24.5	11.9	8.2	4.8	— 1.0	— 5.8	— 4.7
19.0	5.9	5.4	4.0	— 6.9	— 6.2	— 3.3	32.6	13.4	10.1	5.8	— 5.9	— 5.4	— 3.0
23.8	6.6	5.9	3.9	— 5.9	— 5.9	— 4.6	40.8	16.8	10.9	6.7	— 4.0	— 4.9	— 2.3
							21.2*	12.5	13.2	5.1	— 3.4	— 2.5	— 3.7
STATION B													
0	....	4.2	3.3	1.2	1.2	0.2	0	11.5	7.1	6.0	9.1	5.1	4.1
3.2	7.0	7.7	3.9	2.0	— 4.9	— 2.0	3.0	9.5	9.2	6.7	4.8	2.0	— 0.5
6.4	5.7	5.3	4.5	— 2.5	— 2.2	— 3.7	6.0	10.5	8.9	6.8	— 0.1	— 1.0	— 2.8
12.2	8.9	6.2	4.8	1.4	— 2.5	— 6.6	17.6	24.4	10.7	....	9.5	— 8.9	— 6.3
19.1	8.4	7.8	5.1	—11.6	—11.1	— 7.5	18.0	13.8	10.8	....	— 7.1	— 8.8	— 6.7
25.4	8.8	7.9	6.1	— 8.1	—12.7	— 8.1	24.0	18.0	11.7	....	— 5.0	— 6.8	— 5.3
31.8	9.6	9.0	6.0	—18.2	—13.1	— 9.2	30.0	17.4	13.0	....	— 5.8	— 7.6	— 3.1
							9.8*	17.8	10.4	....	4.4	— 1.2	— 4.4
STATION C													
0	....	2.0	3.0	6.1	0.4	0.2	0	7.0	3.9	2.6	4.0	— 0.1	— 2.4
1.4	4.0	3.4	2.9	0.4	— 0.1	— 3.3	1.8	5.8	3.9	3.1	— 4.0	— 6.2	— 6.4
2.8	4.7	7.2	3.2	— 3.4	— 5.2	— 4.4	3.5	8.0	4.5	4.0	— 5.8	—10.0	— 8.9
6.6	6.8	4.6	4.0	—15.5	—13.3	—11.2	8.9	11.5	6.1	4.5	— 8.1	—15.7	—11.0
8.3	6.0	5.3	4.5	— 6.2	—11.6	— 8.4	10.5	9.5	7.2	5.4	—13.6	—15.9	—12.4
11.0	7.2	6.0	....	— 7.9	—14.3	—10.3	14.0	10.3	8.3	5.7	—13.8	—16.7	— 9.8
13.7	6.3	6.4	6.1	—18.4	—14.0	— 5.1	17.5	11.3	8.7	6.1	—23.8	—22.9	—16.9
							8.3*	7.6	6.7	5.7	— 6.6	— 7.7	— 6.7

*Algae collected in plankton set instead of by centrifuge.

matter and an added BOD due to cell respiration.

The third variable in the BOD reaction in the presence of algae results from the introduction of the photosynthetic effect when incubation is carried out under light. Presuming the vast majority of algal cell material to be in a live state, cell respiration under conditions of incubation permitting photosynthetic results in production of oxygen. At the same time, the normal BOD reaction is also continuing under these conditions. As a result, from the experimental laboratory standpoint, if sufficient oxygen is produced to result in a net gain, it must be assumed that sufficient living cells are present to produce oxygen in excess of that required for the normal BOD requirements of aerobic bacterial stabilization.

Biological Determinations

Concentrated algae samples were obtained on July 25, and again on August 8, 1956, from Station A in the Menasha Channel at mile 38.5, at Station B from Rapid Croche Dam at mile 19.5, and Station C above the De Pere Dam at mile 7.0. The concentrated algae samples were obtained by centrifuging 50 gal of river water at 12,000 rpm, and suspending the residue in 1 gal of algae-free water. A blender was employed in re-suspending the algae. An aliquot sample of this 50-to-1 concentration was used for biological analyses.

Ten cc's of the concentrated samples equivalent to 500 cc's of raw water were centrifuged at an approximate speed of 2,900 rpm in a constable tube. The cell pack or cell volume as calculated on a raw water basis was as follows:

Station	Cell Pack, cc per l July 25	Aug. 8
A	0.068	0.086
B	0.058	0.066
C	0.036	0.045

The samples displayed color stratification in the constable tube. The upper white layer was composed principally of single blue-green cells and small fragments of blue-green colonies with few called green colonies and small single-celled green species in lesser numbers. A middle light green layer was principally blue-green colonies and many-celled fragments or larger fragments of these filaments of *Aphanizomenon*, *Anabaena*, and *Gleotrichia*. There were numerous single blue-green cells and some colonial greens with a few diatoms. The lower dark layer was still predominantly blue-green algae, due to their abundance in the sample, but the diatoms were heavily concentrated. The large-celled *Lynbya birgei* and the dinoflagellate *ceratium* was most concentrated in this layer.

The packed cells or residue from the constable tubes were washed in distilled water and were dried and

ignited on a platinum dish. The following results were obtained:

Item	Station A		Station B		Station C	
	7/25	8/8	7/25	8/8	7/25	8/8
Dry wt., mg/l	9.8	14.6	10.6	14.4	4.8	6.4
Ash, mg/l	4.4	6.8	5.4	4.6	2.10	2.8
Vol. sol., mg/l	5.4	7.8	5.2	9.8	2.8	3.6

Algae counts (Table 1) were made from the concentrated material obtained from the three stations.

The biological analyses indicate the following:

1. Lake algae as represented by Sample A appears to be undergoing a change under Fox River conditions. Certain normal lake residents such as *Anabaena, Aphanizomenon* and *Microcystis* are reduced under river conditions and possibly die. Blue-green algae as a whole are reduced under river conditions and species are eliminated.

2. Green algae and diatoms, normally found more abundantly in flowing water, increase under these river conditions. Several new species of green algae, in particular, are added under flowing water conditions. Although smaller in actual size, they no doubt replace the blue-green algae which have died or decreased.

3. Station B appears to represent a transition zone between two algal communities. Station A is representative of typical lake algae, whereas Station C is representative of stream algae with considerable numbers of lake contaminants.

4. Centrifuging and re-suspending breaks up many algal cells, as principally noted in the unidentified single cells of blue-green algae (probably *Microcystis*) and the single cells of *Kirchneriella* (?). If these had been permitted to remain as colonies, the counts would have been lower, but should have been in direct proportion.

5. Casual observation reveals that the greatest concentration of cells, volume-wise, was *Microcystis* and *Aphanizomenon.*

6. The cell pack or cell volume drops off directly from Station A, through Station B, to Station C. From the algae counts on July 25, Station B has more cells than Station A, and Station C has less than either A or B. This is brought about by the increased cell count of green algae at Station B. Blue-green colonies are uniformly larger in size than green colonies; as the cell pack or cell volume becomes reduced. From the samples collected on August 8, Station A displays the greatest number of cells, whereas Stations B and C are similar. There is a descending order of abundance of blue-green forms and an ascending order of abundance of green forms and diatoms.

7. The volatile solids, or the amount of organic material which would determine algal quantity, remains fairly constant for Stations A and B. The samples from Station C contain about half the volatile solids of Stations A and B.

8. On July 25, the abundance of inert material as determined both by microscopic examination and fixed solids determination was greatest from the sample at Station B, and dropped off markedly in the sample taken from Station C. On August 8, the quantity of inert material showed a steady decline from Station A through Station B to Station C.

Effects of Algae

Data on the effect of algae on the BOD reaction are given in Tables 2 to 6.

Table 2 was obtained under experimental conditions while the algal solids content of the incubated samples was progressively increased. The therefore, it is logical that at Station B the total count remains high, where-concentration values were arrived at by determination and calculation. The suspended solids increase both vertically and horizontally for any single original concentration. Duplicate samples of each dilution were also incubated under continuous light, the data showing as negative BOD, or dissolved oxygen gain, in the higher concentration sequences.

Table 3, which is related directly to Table 2, shows the suspended solids concentration in the samples as received, and the corresponding sample as the 50-to1 concentrate obtained by centrifuging the solids from the river water.

Tables 4 and 5 show the rate of oxidation data obtained by dark and light incubation of duplicate samples run under the conditions shown. The "as received" sample was that taken directly from the river at the individual station. The centrifuged sample was obtained by centrifuging 50 gal of river water in obtaining 50-to-1 concentrate. Thus, the centrifuged sample had nearly all of the suspended material removed.

Influence of Live Algae on B.O.D

Differentiation of the soluble and suspended solids BOD load is shown in Figures 1 and 2, which are derived from Tables 4 and 5. In this case the increasing BOD shows an increased demands of the normal sample as compared with the soluble BOD load. In all cases the total BOD is greater than the soluble BOD, which one would expect. However, although the normal BOD at Station A (Lake Winnebago water) and Station C are nearly the same on the 5-day basis on both surveys, the increased normal BOD and the increased soluble BOD at Sta-

TABLE 3

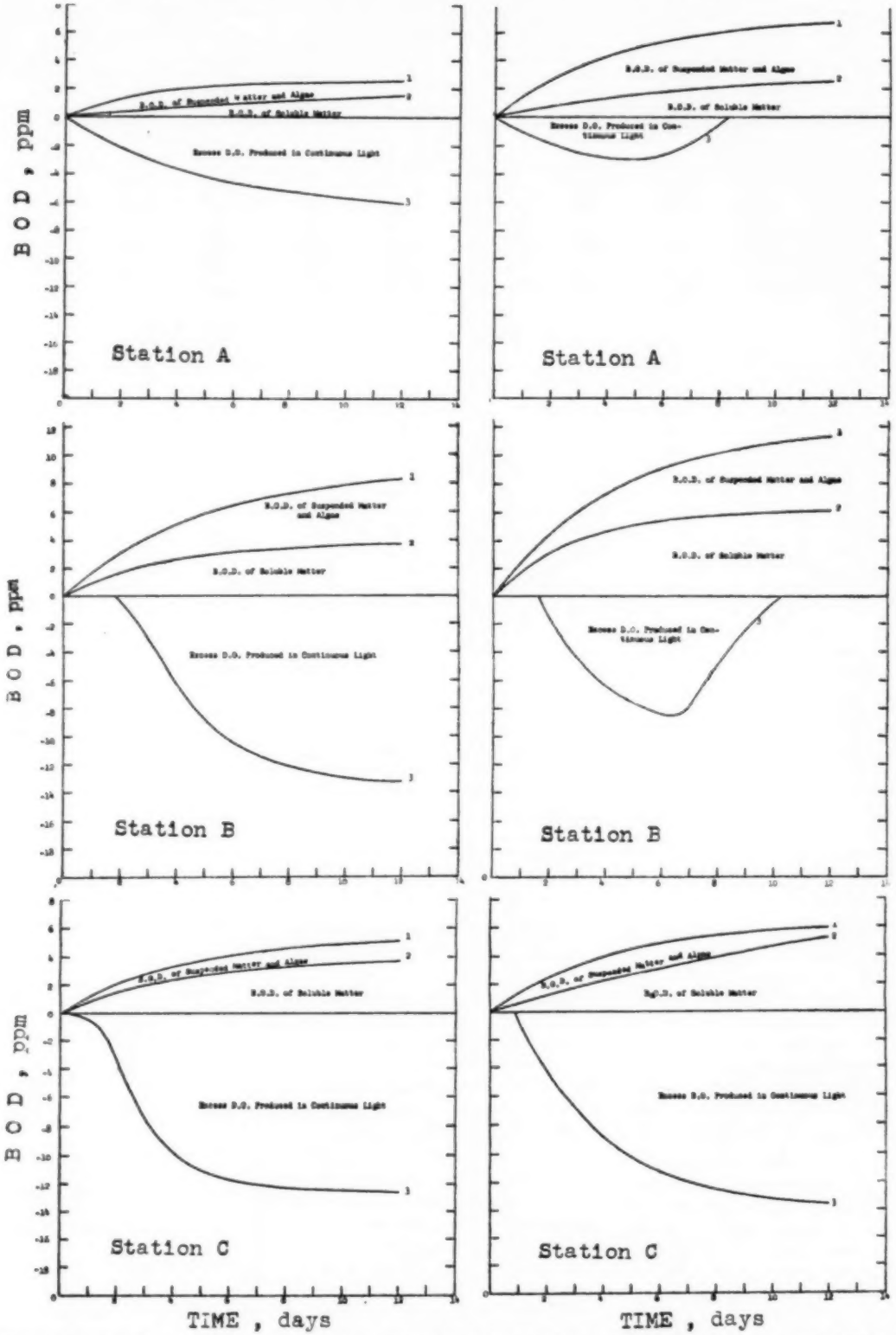
Suspended Solids Data on Algae Studies

Station	Date	Suspended Solids, ppm			
		Total		Fixed	
		As Rec'd	Conc.*	As Rec'd	Conc.**
A	7/25/56	11	475	4	180
B	7/25/56	12	635	4	295
C	7/25/56	6	275	0.4	60
A	8/8/56	14	815	2	320
B	8/8/56	17	600	3	220
C	8/9/56	9	350	2	85
A**	8/8/56	—	424	—	112
B**	8/8/56	—	196	—	44
C**	8/9/56	—	166	—	22

*Concentrated 50 to 1. **Solids collected in plankton net.

FIG. 1—Rate of oxidation comparison on algae studies, July 25, 1956.

FIG. 2—Rate of oxidation comparison on algae studies, August 8-9, 1956.



CURVES 1, as received incubated in dark; Curves 2, centrifuged, incubated in dark; Curves 3, as received, incubated in light.

TABLE 4

Rate of Oxidation Data on Algae Studies, July 25, 1956

Dark Incubation				Light Incubation				Light—Dark Incubation[1]			
As Received		Centrifuged		As Received		Centrifuged		As Received		Centrifuged	
Time, days	BOD, ppm	Time, days	BOD, ppm	Time, days	BOD, ppm	Time, days	BOD, ppm	Time, days	BOD, ppm	Time, days	BOD, ppm
STATION A											
0.76	0.63	0.76	0.28	0.71	— 0.64	0.71	0.39	0.98	1.54	.....	.....
1.73	1.16	1.73	0.44	1.69	— 1.53	1.69	0.59	1.95	2.38	.....	.....
2.77	1.58	2.77	0.46	2.74	— 2.73	2.74	0.54	2.90	3.38	.....	.....
		3.79	0.62	3.76	— 3.71	3.76	0.52	3.98	4.35	.....	.....
Sample lost		4.74	0.75	4.76	— 4.06	4.76	0.39	4.89	5.02	.....	.....
		5.74	0.92	5.76	— 4.57	5.77	—0.08	5.90	5.95	.....	.....
		6.74	0.97	6.77	— 4.83	6.77	—0.82	.....	.....	.....	.....
$k = 0.1572$		$k = 0.0352$		.....		.....		$k = 0.0562$		.....	
$L = 2.51$		$L = 2.36$		.....		.....		$L = 10.90$		.....	
STATION B											
0.67	1.76	0.67	0.44	0.63	0.85	0.63	0.54	0.98	2.20	.....	.....
1.64	2.96	1.70	1.45	1.61	0.39	1.61	1.26	1.95	4.14	.....	.....
2.69	3.84	2.74	2.09	2.67	— 1.57	2.67	1.50	2.90	5.99	.....	.....
3.70	4.76	3.76	3.17[2]	3.68	— 4.40	3.68	1.47	3.98	7.65	.....	.....
4.65	5.53	4.71	3.04[2]	4.68	— 8.26	4.69[3]	1.63[3]	4.89	8.80	.....	.....
5.66	6.24	5.72	3.09	5.69	—10.31	5.70	0.88	5.90	10.45	.....	.....
6.66	6.80	6.72	3.24	6.69	—11.13	6.70	—0.44	.....	.....	.....	.....
$k = 0.0903$		$k = 0.1281$		.....		.....		$k = 0.0502$		.....	
$L = 9.01$		$L = 3.80$		.....		.....		$L = 21.04$		.....	
STATION C											
0.65	0.95	0.65	0.53	0.51	— 0.16	0.54	0.28	0.98	1.78	.....	.....
1.60	1.81	1.60	1.22	1.51	— 1.39	1.50	0.93	1.94	3.63	.....	.....
2.62	2.48	2.63	1.78	2.55	— 4.76	2.56	1.15	2.89	5.30	.....	.....
3.67	3.04	3.67	2.30	3.56	— 8.94	3.56	0.95	3.97	6.72	.....	.....
4.60	3.63	4.60	2.66	4.57	—10.60	4.58[3]	0.68[3]	4.88	7.86	.....	.....
5.60	3.91	5.60	3.30[2]	5.58	—11.56	5.58	0.76	5.89	9.32	.....	.....
6.60	4.47	6.61	3.05	6.58	—11.62	6.58	—2.14	6.90	10.43	.....	.....
$k = 0.1021$		$k = 0.0989$		.....		.....		$k = 0.0418$		.....	
$L = 5.49$		$L = 4.00$		.....		.....		$L = 21.57$		.....	

[1]After 7 days of light incubation, subjected to 7 days of dark incubation. [2]Questioned value. [3]Centrifuged again.

tion B, due presumably to addition of wastes to the stream, is clearly evident. It is also apparent that a significant portion of the BOD at this station, due to suspended matter, is lost by the time Station C is reached, either by conversion of suspended matter to soluble BOD, which remains the same, or by separation by sedimentation from the stream flow.

Although the differences between normal and centrifuged samples easily demonstrate the apparent effect of added BOD due to algae and suspended matter, it must be understood that no distinction is here made between true BOD and algal respiration. Consequently, what appears as a difference in BOD values may in part be the added value of cell respiration, and certainly this should be recognized as a significant factor in interpreting such data.

Data relative to the rate of respiration, k, of the algal cells are given in Tables 4 and 5* under the heading of light-dark incubation. After incubation of the samples from Stations A, B, and C for seven days under light conditions, an increase in algal growth was note. The greatest portion of the soluble BOD having been satisfied, the samples were subjected to seven additional days of dark incubation to obtain the rate data given under the light-dark heading. In all cases except for the sample from Station B of August 8, the rate is within the range of 0.04 to 0.07.

**See following page for Table 5.*

EDITOR'S NOTE

Part II of "Algae and Their Effects on D.O. and B.O.D." (July-August I.W.) will contain Table 6 and Figures 3, 4 and 5, as well as pertinent discussion.

TABLE 5—Rate of Oxidation Data on Algae Studies, August 8-9, 1956

Dark Incubation				Light Incubation				Light—Dark Incubation[1]			
As Received		Centrifuged		As Received		Centrifuged		As Received		Centrifuged	
Time, days	BOD, ppm	Time, days	BOD, ppm	Time, days	BOD, ppm	Time, days	BOD, ppm	Time, days	BOD, ppm	Time, days	BOD, ppm
STATION A											
0.92	1.26	0.91	0.40	0.91	— 1.04	0.90	0.36	1.01	1.01	1.01	0.38
1.93	2.52	1.92	0.72	1.89	— 1.77	1.88	0.54	1.96	2.09	1.96	0.57
2.90	3.47	2.89	0.95	2.88	— 2.47	2.87	0.69	2.93	3.25	2.93	0.88
3.86	4.23	3.85	1.40	3.83	— 2.78	3.82	0.79	3.98	4.22	3.98	1.05
4.91	4.86	4.90	1.56	4.89	— 2.80	4.88	0.77	4.96	5.02	4.96	1.20
5.93	5.35	5.92	1.78	5.89	— 2.73	5.88	0.83	5.96	5.83	5.96	1.47
6.90	5.77	6.89	1.94	6.94	— 1.94	6.93	0.57	6.96	6.40	6.96	1.47
k = 0.0983		k = 0.0654		.....		.....		k = 0.0535		k = 0.0718	
L = 7.24		L = 3.03		.....		.....		L = 11.57		L = 2.23	
STATION B											
0.81	3.17	0.83	1.90	0.80	0.70	0.82	1.81	1.01	2.83	.....	.....
1.82	4.56	1.84	3.18	1.78	— 0.74	1.80	3.17	1.96	5.38	.....	.....
2.79	5.87	2.81	4.12	2.77	— 3.71	2.79	4.00	2.93	7.36	.....	.....
3.75	6.90	3.77	4.42	3.72	— 5.88	3.74	4.18	3.98	9.03	.....	.....
4.80	8.00	4.82	4.96	4.78	— 7.71	4.80	3.34	4.96	10.25	.....	.....
5.82	8.97	5.84	5.38	5.78	— 8.29	5.80	1.72	5.96	11.18	.....	.....
6.79	9.77	6.81	5.74	6.83	— 8.06	6.85	1.70	6.96	11.98	.....	.....
k = 0.1027		k = 0.1559		.....		.....		k = 0.1011		.....	
L = 12.00		L = 6.14		.....		.....		L = 14.92		.....	
STATION C											
0.93	1.36	0.92	1.19	0.89	— 0.11	0.88	0.56	0.97	2.70	.....	.....
1.90	2.34	1.89	2.27	1.88	— 3.46	1.87	1.11	1.94	5.03	.....	.....
2.86	3.05	2.85	3.43	2.83	— 6.00	2.82	1.19	2.99	6.74	.....	.....
3.91	3.81	3.90	4.57	3.89	— 8.83	3.88	0.35	3.97	8.26	.....	.....
4.97	4.42	4.92	5.70	4.89	—10.46	4.88	—0.84	4.97	9.99	.....	.....
5.94	4.85	5.89	7.34	5.94	—11.36	5.93	—3.19	5.97	11.06	.....	.....
6.98	5.17	6.93	8.18	6.93	—12.09	6.92	—5.54	6.97	12.42	.....	.....
k = 0.1072		k = 0.0092		.....		.....		k = 0.0681		.....	
L = 6.27		L = 58.56		.....		.....		L = 18.17		.....	

[1]After 7 days of light incubation, subjected to 7 days of dark incubation.

Most Troublesome Algae in New England Waters*

Phyla Genus	Meaning of Genus Name	Approximate size in S.U. or microns	Factor for size in areal standard methods	PPM dose $CuSo_4$	Odor and/or taste
Cyanophyta					
Anabaena	"I rise or go up"	0.5 S.U.	#1 use area of clump	0.5	Grassy to nasturtium When decayed = pigpen
Aphanizomenon	"Invisible but alive"	0.2 S.U.	"	0.5	" "
Clathrocystis	"A latticed pouch"	2x6 S.U.	"	0.25	" "
Coelosphaerium	"A hollow ball"	3 S.U.	"	0.33	Sweet, grassy
Chrysophyta					
Asterionella	"Little star"	0.2x2.8 S.U.	0.5	.20	Geranium to fishy
Tabellaria	"Little tablet"	0.7x0.9 S.U.	7/8	.40	Geranium to fishy
Synedra	"Knit together"	0.2x2.8 S.U.	3/7	.50	Earthy**
Mallomonas	"A unit (cell) with a lock of wool"	8x25 u	(#1)	0.5	Violet to fishy
Synura	.....	100x400 u d.	(#1)	.25	Cucumber to fishy*
Dinobryon	"Powerful seaweed"	12x35 u	(0.5)	.18	Fishy rockweed
Uroglenopsis	"A wonder or curiosity with tails"	300 u d.	(#1)	.20	Fishy oily (cod liver oil taste)
Pyrrophyta					
Crytomonas	"Hidden unit or cell"	20x30 u	0.5	0.5	Candied violets
Glenodinium	"A wonder whirl"	30x40 u	(2)	0.5	Fishy
Peridinium	"To whirl around"	40x48 u	(5)	2.0	Fishy, like clam shells
Ceratium	"Having horns"	95 to 700 u l.	(15)	.33	Vile stench & rusty brown color
Chlorophyta Chlamydomonas	"A unit with a cloak"	5x15 u	0.25	1.0	

N.B.—#1. These algae vary greatly in size so the area they cover is estimated by squares.

* Chlorine changes and increases the taste.
** Also causes trouble by penetrating sand filters.

* Compiled by Ernest A. Snow, Jr., Senior Chemist, Mass. Dept. of Health, Amherst, Mass.

Meeting in Chicago chalked up a record attendance which heard about . . .

Water Softening, *management and radioactivity*

A report by J. B. STALL, Engineer,
State Water Survey Division, Urbana, Ill.

EDITOR'S NOTE: At this 49th meeting of the Illinois Section of AWWA, held in Chicago in March, thirteen papers, two panel discussions, a luncheon and a dinner address, and an inspection trip occupied the attention of some 450 registrants. Abstracts of four of the several papers are presented here.

■ WATER SOFTENING — Abstract of "Operating Experience with Hinsdale's Sludge Blanket Water Softening Plant" by L. M. Carlman, Supt., Hinsdale (Ill.) Utilities.

Prior to 1956 Hinsdale was served by a lime-soda softening plant designed by C. L. Hoover of Columbus, Ohio and built to serve the city's needs for about 25 years. In 1950 it became apparent that this softening plant was overloaded; a sludge-blanket type water softener was designed by Alvord, Burdick & Howson and put into operation. The equipment was the Hydrotreator type of equipment manufactured by Dorr-Oliver. At Hinsdale the water is softened from about 30 to 35 grains of hardness to about 5 grains.

This softener, 55 ft in dia., 16 ft deep, and has a capacity of 3 mgd. Raw water enters at the bottom and almost all of the chemical reaction takes place in the bottom 18 in. of the tank. The water rises through the "clarifying zone" which varies from 5 to 8 ft deep and contains fine particles of magnesium hydroxide and calcium carbonate. These tend to precipitate but are held up by the upward flow of water. The water is drawn off the top and fed to rapid sand filters.

At Hinsdale close observation was maintained on: (1) density of the sludge, (2) elevation of the sludge blanket, (3) thickness of the sludge blanket. If these were not correctly balanced, improper treatment of the water would result, too much chemicals would be used or carry-over of calcium carbonate onto the filters would result.

When the equipment was put into operation, personnel did not know how to operate it and the operations manual furnished by the manufacturer did not explain its use in fitting the equipment to the Hinsdale water. After several weeks of trial without much success one serious operating error revealed the proper operation of the equipment. In this case, a discharge valve was left open and the entire sludge blanket was lost from the equipment. After closing this valve and putting the system back into operation, it was found that operation seemed to be maximum efficiency. It was found that a slight sludge blanket was best for the Hinsdale water and that the former blanket had been much too thick. In operation now the plant begins to look like the sales literature. The clarifying zone consisted of a white milky churning rolling cloud of lime sludge which stayed 6 to 8 feet below the surface.

The Hinsdale plant operates 18 to 24 hours per day and the Hydrotreator serves the same functions as a mixing tank clarifier and settling basin.

When operations began, sludge withdrawals of 3 minutes duration were made every two hours; now a withdrawal of 1-minute every hour furnishes better water and utilizes less chemical. Now standards are set up for keeping accurate daily records of sludge density, sludge draws, thickness, quantities of chemical use, speed and flows. These records are indispensable in the operation of the equipment. In general, the equipment is satisfactory, it is relatively easy to operate, occupies less space, less power is consumed and dependable control standards can be developed for its operation.

After about 17 months of operation of the equipment, it was necessary to shut the equipment down for cleanout. During the first summer, this equipment was operated at a maximum rate of 3.5 mgd. During the second summer this rate was reduced after about 15 months of use to a maximum of 2.5 mgd. Even this rate was difficult to maintain. In cleaning the equipment it was found that calcium

TWO PRINCIPALS at the meeting were Robert G. Seymour, Assoc. Dean, College of Commerce, University of Illinois, who spoke, at the banquet, on "Creative Thinking," and Dr. T. E. Larson, Head, Chem. Sect., Ill. State Water Survey, who is the newly elected chairman of the Section.

carbonate had deposited heavily in the 12-inch influent pipe and that the twenty-four 3-inch diameter discharge pipes were almost completely sealed by calcium carbonate, their diameters having been reduced to about 1 to 1½ inches. Total deposits of calcium carbonate amount to only one-tenth of that which was taken out of the water.

By changing the point of introduction of the chemicals, this deposition had been overcome. Soda-ash had been introduced ahead of the equipment in a raw water influent chamber. It was then introduced into the center of the equipment and down to the bottom. All chemicals are now introduced into the chamber or unit itself and operation is much more satisfactory.

There have been no problems of freeze-up although the equipment is in the open. No coagulation is needed with the use of this equipment and turbidity of the finished water is superior to earlier treatment methods. The pH of the water at the outlet of this equipment varies from 10.4 to 10.7.

Too great a sludge thickness causes carry-over onto the filters. In drawing sludge directly from the equipment solids are perhaps 5 to 10 per cent.

Samples are taken from five points in the equipment every two hours.

In discussing this paper, G. L. Davis, City of Decatur, Decatur, Ill., described briefly an almost identical experience at Decatur in 1945 in utilizing Accelerator equipment. He said "for two years we had to learn how to use this equipment on our water." In drawing sludge he found about 3 per cent solids in the sludge discharge.

Diatomite Filtration

ABSTRACT of "Experiments with Diatomite Filtration of Lime-Soda Softened Water," by Robert Enzweiler, Supt., Park Forest Water Co., Park Forest, Ill.

About 10 years ago the city of Park Forest was developed. The population is now about 28,000. In 1954 the water company completed a 3.42 mgd. lime-soda softening plant. For the past two years, pumpage during the average day amounted to 1.8 mgd.

The company desired to test the usefulness of diatomite filters to determine their usefulness for use on a lime-softened water, particularly for use during peak load periods. Two types were tested, the pressure type operating at about 50 lb per sq ft and the vacuum type in which diatomite cake is maintained on flat wire screens. Throughout the series of these tests water was taken from the filter effluent of the plant and returned to the top of the filter in order that proper safeguards be taken. Flow was metered in both cases. The vacuum filter operated at a rate of about 1.5 gal per sq ft per min and the pressure type at about 3 gal per sq ft per min or more.

It is the practice of this plant to operate at a constant rate and runs varied from 20 to 24 hours. At the end of such periods it was found that the pressure drops over the filter were as low as 3 pounds. It was not necessary to backwash the filters but it was necessary to shut the plant down and begin again the following day. In this case it was not possible to hold the diatomite cake in the filter but it was necessary to re-establish the cake at the beginning of the following day.

Such tests were made from December through April. Clarity tests of the finished water showed the effect of the diatomite filter was superior to that of the regular filters. Diatomite filters give a satisfactory water. Their first cost is cheaper. Operating costs are probably higher but it is believed that this type of filter has a definite place on lime-softened water especially for use during peak loads.

Radioactivity

ABSTRACT of a paper on "Illinois State Water Survey Program in Radioactivity Measurement," by L. M. Henley, Assoc. Chem., Ill. State Water Survey.

As a data collection and research agency in the field of water resources, the State Water Survey began a program last year to collect preliminary or background data on the natural radioactivity of streams and ground water in Illinois. Samples were collected once per month at U. S. Geological Survey stations on streams in Illinois. Gross alpha and beta activity are measured with a proportional counter such counts being made on both suspended solids and dissolved solids. A total of 169 samples have been collected from 21 streams in Illinois since May, 1957. Alpha activity has not been noted to exceed 5 micro micro-curies per liter. Sufficient samples have not been analyzed to correlate with rainfall, streamflow, etc. Radioactive fallout has been easily detectable and yet the "natural" activity range of river waters has not yet been established. In approximately 13 per cent of the samples collected, it was found that beta activity was greater than 100 micro micro-curies per liter.

In cases of high activity, it is evident that this takes place in the suspended matter since it is noted that in no sample was the dissolved activity more than 100 micro micro-curies per liter. This points out the need for further sampling of bottom sediment deposits.

A few of the well water samples have shown a significant radioactivity. Further testing of these samples at Argonne Laboratories found activity to be due almost entirely to isotopes with very weak radiation.

Analytical methods do not appear to be a major barrier since a number of high quality measurement devices are on the market. Methods of preparation of samples are not standard, however, and it would be highly desirable for methods to be standardized for preparation of samples.

Management

ABSTRACT of "Spend What You Earn," by H. S. Merz, Supt., Water Dept., Rockford, Ill.

Prior to 1946 it was the practice in Rockford for the Water Department to (1) construct a budget and (2) estimate water revenue. The surplus revenue or difference between these two items was put into the general fund and used for general operations of the city. If the city's needs were great, the Water Department budget was reduced. If the city's needs were urgent water rates were increased and surplus was put into the general fund. Believing that it is wrong to use the water works system as an indirect method of levying taxes, an ordinance was passed in 1946 in Rockford to control and limit such diversion.

Since such diversion is practiced in

a great number of cities, it was realized that it could not be terminated immediately so the ordinance was oriented toward the control and limit of such a diversion. It was desired to choose a sum which could be justified as an expense of the water utility and classified as a non-operating expense for the utility. This ordinance was passed and righted a wrong that was slowly but surely liquidating the capital of the water works system.

Payments made by the water system into the non-operating expense account include, first, an amount equal to a return of 4½ per cent on the capital investment of the water system exclusive of water revenue bonds. Second, a payment is made in lieu of taxes based on the valuation of the water system at the appropriate tax rate. Third, an amount is paid for rent of city owned property occupied. Fourth, a franchise tax is paid which in 1957 amounted to $10,000. Fifth, a sum is paid for legal expense which represents the utilization made by the Water Department on the city legal offices.

The credit in this non-operating expense account included hydrant rental, each hydrant at a rate of $25 per year and rental of 16 drinking fountains at $50 per year.

The balance of this account, the total expense items payable to the city less the credits, represents an amount actually paid by the water system to the city government. In any operating year it is paid to the general corporate fund in the amounts agreed upon. Any surplus income from the operation of the Water Department is thus allowed to accumulate in a surplus account for use of the Water Department.

Public opinion is the weapon which is used to keep this ordinance in effect. It is believed that it would be extremely difficult to repeal the ordinance at the present time since it has now been in effect long enough so that the results are visible in more plant, service and a business-like attitude in the operation of the Rockford Water Department.

Brainstorming

ABSTRACT of talk on "Creative Thinking," by Robert G. Seymour, Assoc. Dean, College of Commerce, University of Illinois, Urbana, Ill.

What is the difference between mediocrity and success? In many cases it is simply the use of more good ideas. While it is necessary to be able to put a new idea into effect the process of idea-getting is one which can pay high dividends to any business operation such as a water system. We all have creative powers. It is merely necessary to stimulate them in order to produce new ideas.

A new idea is a novel combination of known elements, or a rearrangement of elements not previously known. An original concept is an adaptation of ideas.

The approach to creative thinking is as follows:

1. Seek an unfilled need or opportunity.
2. State the problem.
3. Give the facts. Study what is known.
4. Incubate (this is a very frustrating period during which not much productive activity comes forth).
5. Find alternatives.
6. Judge and select.
7. Test and improve.

Humans get into physical and mental habits so it is necessary, to begin with, to enlarge our thoughts or to send thoughts outward in new directions.

In considering a product, process, method, or idea which is the object of our creative thinking process the following considerations are pertinent.

1. Adapt.
2. Put it to other uses.
3. Magnify; or make it longer or stronger.
4. Minify; or make it lighter, condense, split it up.
5. Reverse the process.
6. Modify the color or shape.
7. Substitute.
8. Rearrange.
9. Combine.

A group of six to ten people is an ideal group for "brainstorming" in which the "stop" part of the mind is not given its full range but emphasis is put on the "go" part of the brain. In this part of the process the main object is the getting of ideas and not the judging or evaluating. This is all deferred till later. Only positive ideas are allowed and each person participating allows his imagination to roam, he rides on the ideas of others and each participant stimulates the thinking of others present. It is necessary to have a chairman who chastises negative ideas who keeps asking "What else?" What else?" and a secretary who writes down ideas. The only limit on such a group is the speed with which the secretary can write. In brainstorming the following are pertinent:

1. Defer thinking.
2. Anything goes.
3. Keep going; quantity is important.
4. Adapt or hitchhike on ideas of others present.

New Officers

The following persons were elected to office for 1958. Chairman, T. E. Larson, Illinois State Water Survey, Urbana; Vice Chairman, Armon Lund, Supt. of Public Works, Wilmette; Senior Trustee, J. C. Vaughn, South District Filtration Plant, Chicago; Intermediate Trustee, K. A. Steel Chemicals, Inc., Chicago; Junior Trustee, William J. Downer, State Department of Public Health, Springfield; Section Director, H. H. Gerstein, Department of Water & Sewers, Chicago; Secretary-Treasurer, Dewey Johnson, Cast Iron Pipe Research Association, Chicago.

Dewey W. Johnson, Research Engineer, Cast Iron Pipe Research Association, Chicago was nominated for the Fuller Award for the Illinois Section for 1958.

Forty-four Safety Awards were made to water plants operating in Illinois. The East St. Louis and Interurban Water Co. was nominated for the Wendell La-Due award by the section. This utility serving East St. Louis accomplished an accident frequency reduction of 83.5 per cent in 1957 as compared to 1956 with an exposure of 423,000 man hours.

78th annual meeting, held in Dallas, Texas, heard call to . . .

Do It Now!!!

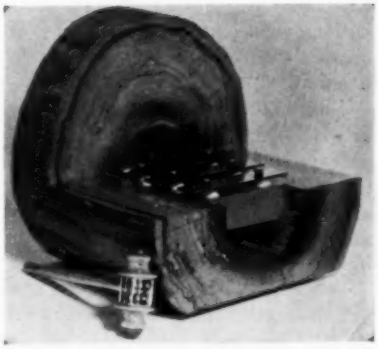
EDITOR'S NOTE: Keynoting the opening session of the Dallas meeting, Fred Merryfield, President of the Association, called upon AWWA members throughout the country to advance the water works industry through efforts to obtain public recognition of the importance of adequate water supply, to improve water works management, and to spend, now, the money necessary to improve and obtain the adequate water supplies which the American people should have, and to accomplish this necessary expenditure without resorting to Federal aid.—In short, "Do It Now!"

To emphasize the importance of "Do It Now," John H. Murdoch, Jr. said, "By taking immediate action to solve the critical water shortages that exist in the United States, the country can help beat the current business recession without recourse to Federal or State aid." Mr. Murdoch's remarks were part of his talk on the work and ideas of the program "Operation Water Works Advancement."

Also participating in the opening session were two past presidents, W. R. LaDue who spoke on the AWWA policy regarding recreational use of water reservoirs and L. R. Howson who spoke on AWWA standards.

At the meeting of the Board of directors, it was voted to raise the dues from $10 to $15 a year for active members starting next year and also to raise the annual dues of associate and corporate members. The Board also passed two resolutions establishing a certification mark and amplifying the policy concerning certification.

These four papers, the Board action, and the activities of the divisions and the manufacturer's Assn. are reviewed here. Next month, papers presented at other sessions will be reported.



THESE CALL CHIMES, made from section of old tree main installed in Philadelphia between 1800 and 1820, were presented to AWWA by WSWMA to commemorate the 50th anniversary of WSWMA.

■ ONE HIGHLIGHT of the convention was the presentation of a set of call chimes to the AWWA at the opening of the first session. The call chimes, shown here were presented by Harry E. Schlenz, past president of the Water & Sewage Works Manufacturers Assn. on behalf of and in commemoration of the fiftieth anniversary of that association, are made from a section of old wood main, installed in the city of Philadelphia between 1800 and 1820.

The idea for the presentation was conceived by R. V. Ford, President of the WSWMA and George W. Kelsey, Vice Pres., B-I-F Industries, Inc. The section of pipe carries a gold plaque on one end reciting the history of the main and the occasion of the presentation. The gavel was fashioned from the same tree pipe and bears the inscription, "AWWA — Partners in Service — WSWMA."

Presidential Address

FRED MERRYFIELD, Prof. of Sanitary Engineering, Oregon State College, Corvallis, Oregon and President of the AWWA accepted the call chimes on behalf of AWWA and followed this acceptance with his presidential address on "Water Supply Advancement." As a basis of his presentation, Prof. Merryfield reviewed the objectives of the Association as expressed in the AWWA Constitution.

Briefly, these objectives are:

1. Advance the knowledge of design, construction, operation and management of water works.
2. Consider and deal with problems involved in production and distribution of safe and adequate water supplies.
3. Promote satisfactory relationships with the consuming public.
4. Give proper consideration to and express opinions on practices which will enable the industry to

render the best possible service to the public.

5. Do whatever things are necessary and proper for the accomplishment of these objectives, all of which shall be consistent with the public interest and with the interests of the water works industry.

President Merryfield said that while we have learned to develop good quality water and to develop systems and equipment for production and distribution, we as an industry have not learned to promote a satisfactory relationship with the consuming public. We have failed to protect the interests of water works managers and personnel and the industry at large. We need to gather into this association more personnel and to increase the number of trained men entering the industry.

While AWWA has been engaged in public relations for some time, there is still too little recognition of the fundamental value of water works service to health, comfort and prosperity of the individual and the community. There is still too little recognition by the public of the need for the development and growth of public water supplies.

The public does not appreciate the margin of safety under which this industry operates, the time required for operations, or the time required for advance planning to meet the growth of communities. As long as water is sold for about 5 cents a ton, the public can not appreciate its value. It is the job of every water works manager, and operator to inform the public of the importance of water supply and of the men who are engaged in its service.

President Merryfield also called attention to the results of a survey which showed that in the United States:

20 per cent of all water supplies are deficient in supply.
40 per cent are deficient in transmission capacity.
30 per cent are deficient in pumping capacity.
40 per cent are deficient in treatment facilities.
30 per cent are deficient in ground storage.
40 per cent are deficient in elevated storage.
60 per cent need improvement in distribution systems.

The water works industry must be prepared to spend $750 million each year just to keep systems and facilities up to present standards, which are not high enough. The current business climate and financial market are favorable for a concerted program to bring our water supply systems into balance. Now is the time to set in motion, "Operation Bootstrap," without Federal or State aid.—"Let's work our way to Prosperity with AWWA's Do-It-Now program."

President Merryfield concluded with the observation that there is no organization that does not need improvement; in the water works industry the men are underpaid, there are two few trained men; there are two few trained men entering the field; and there are too many men unrecognized for the service they render their communities. To offset this undesirable situation, the AWWA Board has approved the program for "Operation Water Works Advancement" with the slogan, "Good water, the life blood of your community."

OWWA

JOHN H. MURDOCH, JR., Consultant, and retired Vice President and Counsel of the American Water Works Service Co., of Philadelphia spoke on the work of the committee on Operation Water Works Advancement. He said that through this public information program we want to make the people understand the value of adequate water supply and service. OWWA was not started to pat ourselves on the back; it is to obtain better public understanding and to prod ourselves.

The OWWA Committee will work with local sections as well as on the national level. One thing local water works managers must do is to create a water works team, a team that will be convinced that excuses are no substitute for service, a team that knows that cheap water is too cheap.

Local water works managers must be trained in all phases of the industry, business, engineering, chemistry, administration, etc.; they do not need to be experts in all phases but they must understand each.

Both locally and nationally there is much work to be done, and Mr. Murdoch said why not "Do It Now." Mr. Murdoch also emphasized Pres. Merryfield's suggestion that by taking immediate action to solve the critical water shortages that exist in the United States, the country can help beat the current recession without recourse to Federal or State aid. Work should be started immediately on more than $600 million worth of projects ready to go. "This is work now ready to be done. At the same time, local water supply agencies should complete their plans to carry forward the billion dollars worth of projects that are needed to create adequate water systems . . . which have been held up for many years. Unless such action is taken immediately, urban America will find itself faced with even more critical water shortages. Water supplies available for public, industrial and domestic use are, in many cases totally inadequate to take care of present needs."

The time for such action will never be more favorable than now, since banks and investors now have money to loan for any sound water works project. Trained engineering personnel and labor forces are at last available to the industry and the cost of materials is not likely to drop below present levels.

"Water pollution is also one of the very serious problems confronting us today. When a stream is polluted, it often becomes unfit for domestic supply, even with treatment, and it also becomes unfit for industry. When that happens, it is necessary to go many miles for a good supply and to go into competition with other communities for the few remaining safe sources. New York City is an example of the necessity for going many miles for water supply because the supply near at hand, the Hudson River, is so polluted. As a cure for this general problem, Mr. Murdoch urged the construction of better sewage disposal systems and the development of better industrial waste treatment. Construction of these facilities will also aid in combating the recession.

Local water supply projects can be financed, developed and operated independently if they are properly planned and if local water works men make the needs known and the benefits clear to the public. Once shown,

the community needs for projects and the advantages to the community of adequate high quality water service, the people of a community will be glad to pay the water rates required to make such service possible.

"Water has always been taken for granted and, for years, it has been far too cheap. To boast about how cheap water is a mistake. Men who do so, lack vision to understand that you can not have good service today with rates that stem from the historic competition or public water supply systems with the now vanished backyard wells. We must bring ourselves to being ashamed of the inadequate service we give for which inadequacy we offer the excuses of inexcusable poverty.

"If on the average, water rates were increased by 25 to 50 per cent in urban communities, it would make it possible to revolutionize the entire water works situation and the dollar costs to our customers would still be the smallest item in the budget. This can be done only through education of the public."

The reasons water works projects have been shelved in the past is that throughout its history the industry has been hampered by unrealistic rates. For more than ten years it has not been possible to get engineering personnel to do the detail work required on these projects, and with low rates, salaries could not be paid to attract engineering personnel the industry needs in operation. Today conditions have changed, engineers are easier to get, money is available from investors. Any properly managed utility can get the money it needs now to satisfy these long deferred needs. By ordering now, water utilities can help stimulate manufacturers to produce. Such action will also help to beat the recession.

Mr. Murdoch's paper was discussed by Jos. F. O'Grady, Prod. Mgr. Water Meter Div. Rockwell Mfg. Co., and Chairman of the WSWMA Committee on Public Relations, and by Richard V. Ford, Vice Pres., Ford Meter Box Co., and President of WSWMA. Mr. O'Grady explained the development of the Water Resources Council and its efforts to publicize the work of the industry. Mr. Ford explained a case history to show how important it was to have the public understand need for adequate water supply service.

Reservoir Use

WENDELL R. LA DUE, Chief Engr. and Supt., Bureau of Water Supply, Akron, Ohio, and a past president of AWWA reported on the AWWA Policy on Recreational Use of Water Storage Reservoirs. It was a year ago in Atlantic City that the Board passed a resolution which said, that "any decision on recreation or other secondary uses of reservoirs should be left entirely to local discretion, and that the AWWA registered its opposition to state legislation relating to opening domestic water supply reservoirs to fishing and other secondary uses."

As a result of that resolution an Ad Hoc committee was appointed to study and report on the matter. At the Annual Board meeting of AWWA in January of this year a policy was adopted (see page 167 of the April issue of Wat. & Sew. Wks.). The committee recognized many elements to the problem, particularly that of the public attitude toward ownership. Unfortunately, the public feels that a reservoir is public property, it has a right to use it. In the case of private water supplies this attitude is missing. For public supplies, there must be some restrictions and the public must be made to understand that to use a reservoir for other than water supply is a privilege.

Quality control of water supplies is important. It is necessary to reassert a firm policy that "purveyors of public water supplies have always had the primary responsibility for providing the consumers with a safe and palatable water. This traditional objective had a major bearing on the attitude which the water works executive must take when considering public entry to reservoirs and reservoir lands, which are dedicated to the highest benefit of the people served by the installation."

Mr. LaDue spoke of the problem of viruses and the fact that consideration needs to be given to such carriers of disease. Adequate supply has a definite priority over recreational uses.

The AWWA statement of policy is not a regulation or rule to be applied generally to all occasions. It is definitely subject to tailoring at the point of use and application, in Mr. LaDue's opinion.

AWWA Standards

LOUIS R. HOWSON, Consulting Engineer, Chicago, and also a past president of the AWWA spoke on "AWWA Standards — Shall they be enforced?" In approaching this subject, Mr. Howson said he considered several questions: 1. Why are AWWA standards prepared? 2. What is the extent and present status of AWWA standards? 3. Who uses AWWA standards; how extensively are they used and relied on? 4. Are AWWA standards serving a real need? 5. Is compliance with AWWA standards essential in the public interest? 6. Whose responsibility should it be to see that materials purchased under AWWA standards are in compliance with the standards? 7. Should compliance with AWWA standards be voluntary or compulsory. 8. Who should do the policing, if such is to be done?

Mr. Howson then reviewed the history of standard specifications of AWWA and spoke on how to achieve compliance. He mentioned two alternatives; either leave things as they are and recognize that there are some abuses or approach the matter in a positive manner.

Mr. Howson suggests the better idea would be to incorporate these aproaches:

1. AWWA must make available the best standards possible and keep them up-to-date.
2. The purchaser should be informed relative to the material desired and the standards under which he receives proposals.
3. The manufacturer should comply with the standards on which his bid is requested. If he varies therefrom in any particular it is his moral obligation to refrain from quoting or submit in writing to the purchaser, the details of any items on which his quotation diverges form the standards.

Mr. Howson believes:

1. That the standards are serving a

real need and are contributing to the public welfare.

2. The standards should be enforced.
3. Enforcement can be strengthened by a voluntary procedure adopted by the Board of Directors.
4. Probably voluntary compliance will be sufficient but if not, stronger measures should be studied and adopted.
5. The procedure should be viewed as probationary and subject to continuing observation. Its success depends on full cooperation of all segments of the industry.

Board Actions

At the meeting of the Board of Directors, actions concerned several items of interest to the members. Of particular interest was the increase in dues to meet the expenses of the new OWWA program. The dues have not been raised since 1923 and it was decided that the increase should be from $10 to $15 a year for active members with appropriate increase in corporate and associate members dues also.

The Board also adopted an AWWA certification mark to be placed by licensees on their products to certify conformity with the applicable AWWA standard. Until further notice this certification is applicable to Fire Hydrants (Spec. C-502), Gate Valves (Spec. C-500, up to 12 in. only) and Meters (Spec. C-700-705).

A committee on certification was created and the procedures for certification were adopted. Another resolution directed that henceforth no manufacturer's products may use the initials "AWWA" in any form whatsoever on such products except by complying with the procedure which authorizes the use of the certification mark. This directive to become effective Jan. 1, 1960.

Division Officers

Officers were elected by the four divisions to serve for the ensuing year.

Distribution Division

Chairman — James B. Ramsey, Chief Engr. and Supt., Water Dept., Kansas City, Mo.

Vice Chairman — Byron E. Payne, Chief Engr. and Supt., Louisville Water Co., Louisville, Ky.

Secretary — H. J. Graeser, Supt. of Water, Dallas, Tex.

Trustees — J. G. Carnes, Philadelphia and Archie Rice, Corvallis, Ore.

Management Division

Chairman — W. D. Hurst, Chair. of Comm., Greater Winnipeg Water & San. Dist., Winnipeg.

Vice Chairman — W. R. Seeger, Gen. Mgr. and Chief Engr., Marin Municipal Water Dist., Marin, Calif.

Secretary — Gerald Remus, Gen. Mgr., Dept. of Water Supply, Detroit, Mich.

Trustees — C. F. Wertz, Miami, Fla. and Chas. Wilson, Salt Lake City, Utah.

Purification Division

Chairman — J. M. Jester, Engr., Maint. and Operation, Washington Suburban Sanitary Dist., Hyattsville, Md.

Vice Chairman — Chas. A. Black, Cons. Engr., Black Assoc., Gainesville, Fla.

Secretary — H. E. Hudson, Cons. Engr., Hazen & Sawyer, Detroit, Mich.

Trustees — Jos. A. Sanchis, Los Angeles, Calif., and A. H. Ulrich, Austin, Tex.

Resources Division

Chairman—John W. Cramer, Cons. Engr., Lincoln, Neb.

Vice Chairman—A. R. Davis, Dir., Wat. & Sew., Austin, Tex.

Secretary — Roy W. Morse, City Engineer, Seattle, Wash.

Trustees — Lynn M. Miller, Lansing, Mich., and Irving Anderson, Washington, D. C.

Manufacturers Association

Six new members were elected to serve on the Board of Governors:

Hubert F. O'Brien, A. P. Smith Co.

Harry E. Schlenz, PFT, Co.

Wentworth Smith, Neptune Meter Co.

Harvey S. Howe, Lock Joint Pipe Co.

LeRoy Evans, Mueller Co.

T. W. Fauntleroy, Pittsburgh-Des-Moines Steel Co.

WSWMA officers elected by the Board of Governors, to serve for the year beginning January 1, 1959 are:

President — E. E. Alt, Chicago Bridge & Iron Co.

Vice President — George W. Kelsey, B-I-F Industries, Inc.

Treasurer — Reg. Hayes, Hydraulic Development Corp.

Manager — John G. Stewart

Secretary — Miss Dorothy Dimmers.

Radio and Television

As a part of the public information program, two radio broadcasts and one television broadcast went out of the local Dallas stations. On Sunday evening at 6:30 p.m. (EST) over the entire NBC network of nearly 200 stations, Alex Drier, noted commentator, saluted the field of public water supply in his program called "America on the Go." Drier informed his listeners that this country, with its rapidly growing population will require 50 per cent more water by 1975. He also explained the importance of public water supply, and the importance of the AWWA and WSWMA to it.

In a local radio program, President Fred Merryfield was interviewed; he and incoming president Lewis S. Finch were also interviewed on a TV show. Both stressed the importance of the water works field and adequate water supply to the public.

At the end of the annual banquet, which was the largest to date, Mr. Finch assumed the president's office.

Registration

With a preregistration of 571, it was expected that the attendance might top the previous year but it fell short by 43. The accompanying tabulation compares the past five meetings:

Year Place	1954 Seattle	1955 Chicago	1956 St. Louis	1957 Atlantic City	1958 Dallas
Water Works Personnel, etc.	901	1167	1154	1378	1314
Equip. Mfrs. Repr.	635	908	874	1020	1023
Ladies	527	512	510	669	687
Total	2063	2587	2538	3067	3024

Results of experimental studies were used to confirm the soundness of design of . . .

The Uniflow Tank *Part II*

by JAMES L. DALLAS, Associate Sanitary Engineer, Massachusetts Department of Public Health, Boston, Mass.

PART II of this article covers the experimental work on an improved sedimentation tank, and presents three diagrams prepared to assist engineers in the design of settling tanks. This article was presented as a paper at the Second Waste Treatment Conference at Manhattan College in New York City and is published here by permission of the college. Part I appeared in the previous issue of *Water & Sewage Works.*

■ RESULTS OF EXPERIMENTAL studies on the type of tank described in this paper and conducted at the Ward Street pumping station in Boston were presented by Thomas and Dallas.[8]

The tanks were identically rectilinear in plan and similar in all respects except depth and bottom slope (see Fig. 8). The settling tanks were operated in series with coagulating tanks that had a volume of about 45 gallons each. The coagulation tanks were stirred by paddles rotating at 15.4 rpm. The settling tanks were equipped with sludge removal flights ¾ by ¼ by 23.4 inches, spaced at 16¼ inches; these traveled at a speed of about 1 ft per minute. The coagulation tanks each measured 3 ft long, 1 ft 5 in. deep, and 1 ft 5 in. wide.

The tests definitely corroborated the theoretical reasoning. For equal flow rates, the detention period in the

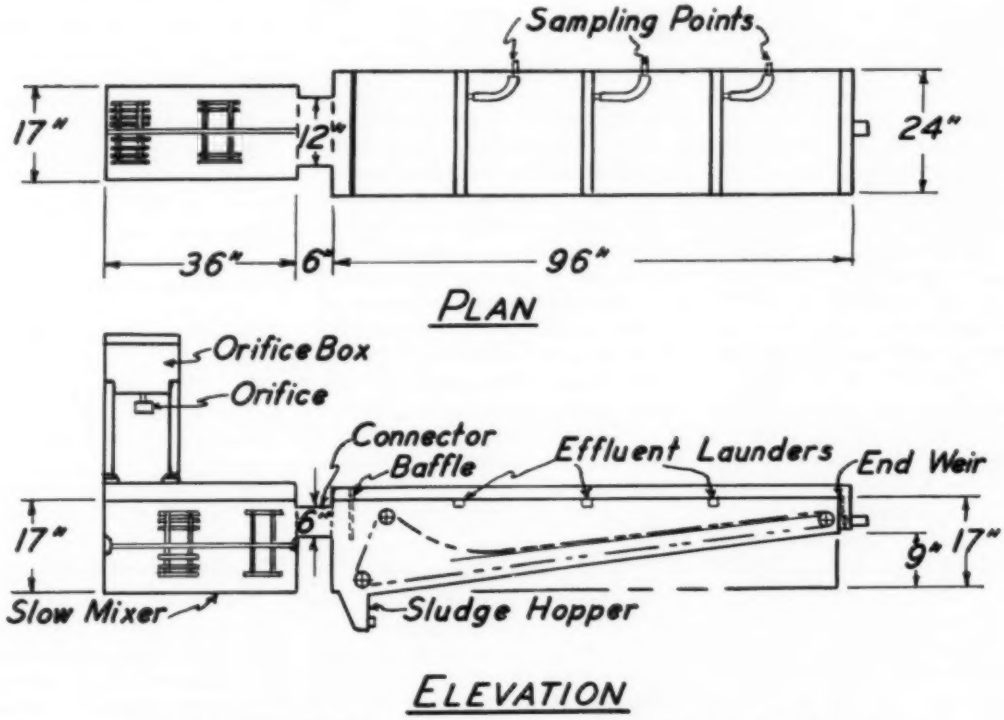


Fig. 8—EXPERIMENTAL pilot plant at Ward Street pumping station, Boston, Mass.

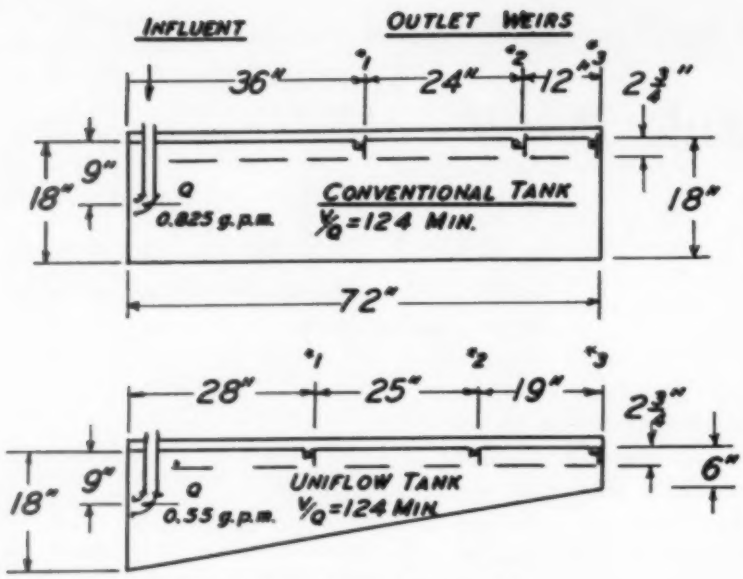


Fig. 9—ARRANGEMENT of tanks for comparison tests.

sloped-bottom tank was about three-fourths that of the conventional, yet it gave very nearly the same efficiency. In one-half the runs the sloped-bottom tank gave a higher B.O.D. efficiency. Suspended solids and turbidity determinations indicated about the same performance in both tanks.

The results of a series of flow tests conducted with fluorescein dye and radioiodide (I^{131}) as tracers, indicated that (a) there was about the same degree of stability, as evidenced by the shape and reproductibility of time-concentration curves plotted from tracer determinations on effluent samples collected at regular intervals; (b) despite its shorter detention period, the sloped-bottom tank did not short-circuit to a greater degree than the rectangular (flat-bottom) tank; and (c) there was indication of the absence of dead spaces in the flow that are relatively ineffective in sedimentation.

To determine the effectiveness of the adverse slope in arresting the movement of high-density currents along the tank bottom, a special series of tests was conducted on two model tanks at the Lawrence Experiment Station of the Massachusetts Department of Public Health. Figure 9 shows the pertinent features of the set-up of the tanks and Fig. 10 shows the pertinent data and results of a typical test run.

The inlet flow to the tanks was adjusted to give the same detention period in each tank (124 min.) An arrangement was made to dose the sewage influents with a sodium chloride solution. The average chloride concentration in the influent during the 3½ hr run of sewage at normal chloride concentration (42 ppm).

The test was conducted to ascertain the relative effects on the two tanks when they were suddenly subjected to influent sewage of higher density than that in the tank at the time.

Sewage treatment plant settling tank influents are subject to changes in their composition and characteristics which can and do increase or decrease their relative densities. Such changes can be brought about by temperature changes, infiltration of salt or fresh water, variations in suspended and dissolved solids content of the sewage, and variations in the quantity of sewage flow.

The results of the previously mentioned tests reveal that:

1. The chloride content of the influent stayed fairly constant throughout the 3½ hr run.

2. An increase in the chlorides content of the flat bottom (conventional) tank appeared in approximately 64 minutes (51 per cent of the detention time), but they did not appear in the sloped-bottom tank until approximately 89 minutes (72 per cent of the detention time) after the run was started; it exhibited a 40 per cent longer delay in showing effect of increased salt content in its effluent.

3. The samples collected from the bottom of the uniflow tank were of a consistently higher chloride content than those from the flat-bottom tank. This demonstrated a greater tendency to "pocket" the dense influent in the bottom and to reduce the portion of the tank in which mixing takes place.

4. After the time of first appearance of increased chlorides in the sloped-bottom tank, the strength thereof increased more rapidly and reached a higher concentration than in the case of the flat-bottom tank; indicating more uniform displacement of the tank contents.

5. The respective volumes of the two tanks above the elevation of the inlets and portion of the tank in which concentrated mixing of the dense sewage occurred, were 50 per cent in the flat-bottom tank and 72 per cent in the sloped-bottom tank. These volumes represent 62 and 89.3 minutes of detention time, respectively, and correlate closely with the 64 minutes and 89 minutes delay in the times for appearance of chloride in the effluents. Mixing of the dense influent in the portion below the inlet and gradual vertical displacement of the liquid above thereafter is indicated.

6. The differences in time lag between outlets 1, 2, and 3 are in part due to the different volumes of the compartmentalized portions of the tanks resulting from weir-baffles and the different spacings.

These later observations point up the effectiveness of the adverse slope in reducing the deleterious effects of high-density-fluid induced movements at velocities greatly in excess of the displacement velocity. They also indicate the desirability of conducting the influent sewage to or near the bottom of the tank, especially during such times as the density is high. It further demonstrates that both the flat-bottom and sloped-bottom tanks function substantially as vertical-flow tanks under the conditions of deep inlet and high-density influent.

Diagrams to Facilitate Design

The three accompanying diagrams (A, B and C) for design of uniflow tanks and uniflow tank weirs have been prepared and are here presented to assist the practical engineer in the design of settling tanks.*

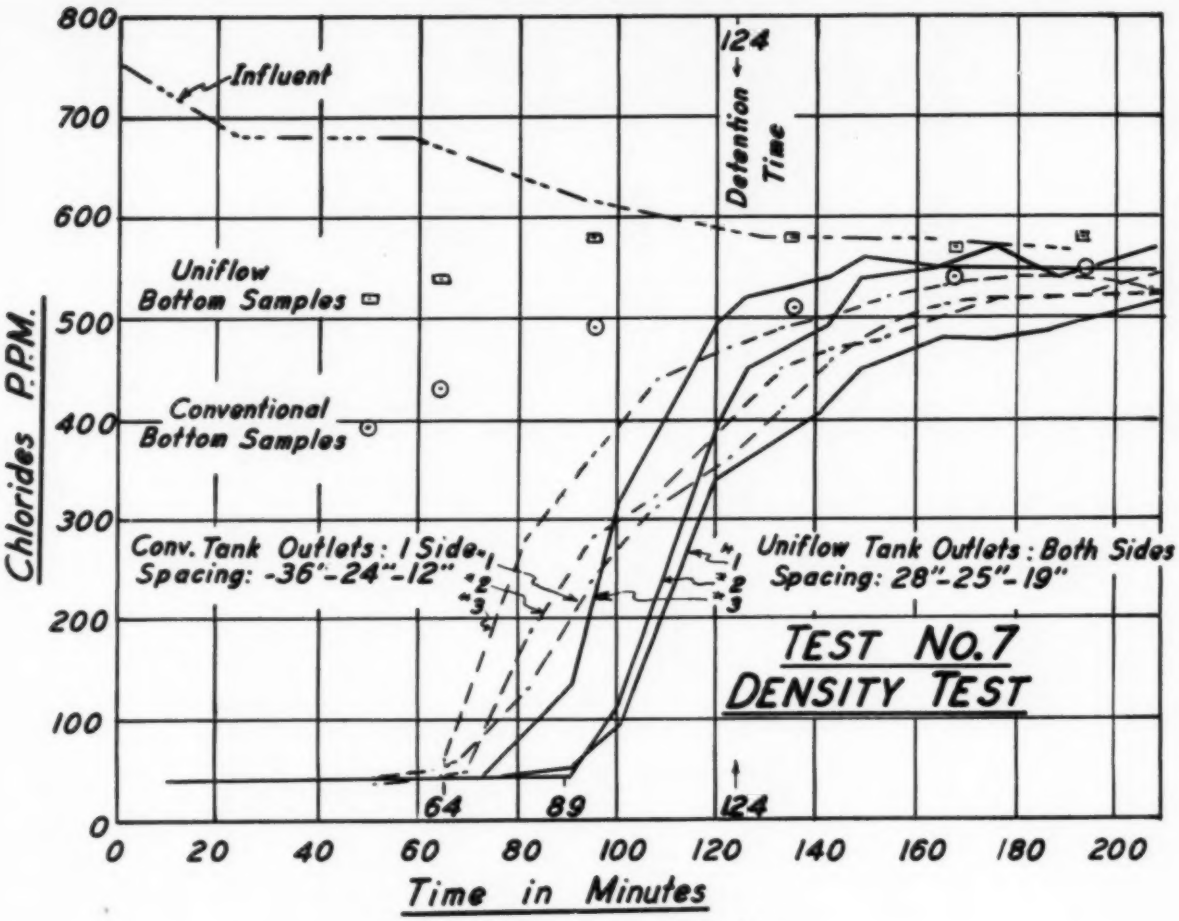


Fig. 10—RESULTS of comparative tank test.

The diagrams facilitate the rapid design of settling tanks for loads varying from 0.1 to 10.0 mgd while permitting the exercise of engineering judgment as regards:

(a) Overflow loading rates (gpd/sq ft).

(b) Conventional width in feet up to 83 ft.

(c) Ratios of lengths to widths.

(d) Ratios of horizontal velocity effecting scour to critical-size particle settling velocity as related to overflow rate.

(e) Weir loading rates (gpd/ft).

The diagrams are self-explanatory and simple to use, and indicate a few suggested parameters of design.

Summary

A discussion of certain basic sedimentation concepts is presented, with observations which lead to an efficient settling tank design incorporating use of a radically sloped bottom with multiple transverse effluent troughs. This produces a tank with (a) conventional depth and water mass at the inlet end to dissipate influent turbulence, (b) uniform conventional horizontal velocity, (c) hydraulic stability through manifestation of converging streamlines throughout the tank, (d) characteristics to minimize the effect of density currents, (e) quicker adjustment to temperature changes, (f) minimal wind-induced surface currents, and (g) facilitation of sludge collection at acceptable weir and surface loading rates.

The structural aspects of design permit use of conventional equipment, flexibility of layout to accommodate site characteristics, possible lower construction costs resulting from greater over-all efficiency, and savings in excavation and structural design.

In addition, useful diagrams are presented to facilitate the rapid design of settling tanks ranging in capacity from 0.1 to 10 mgd while at the same time permitting exercise of engineering judgment as to overflow rate, length-width ratio, critical horizontal velocity effecting scour, and weir loading rate.

Acknowledgments

The author wishes to acknowledge the cooperation, help and assistance of Dr. Harold A. Thomas, Jr., Gordon McKay Professor of Sanitary Engineering, Harvard University and of J. J. Gilbert, Link-Belt Company, in the preparation of this paper.

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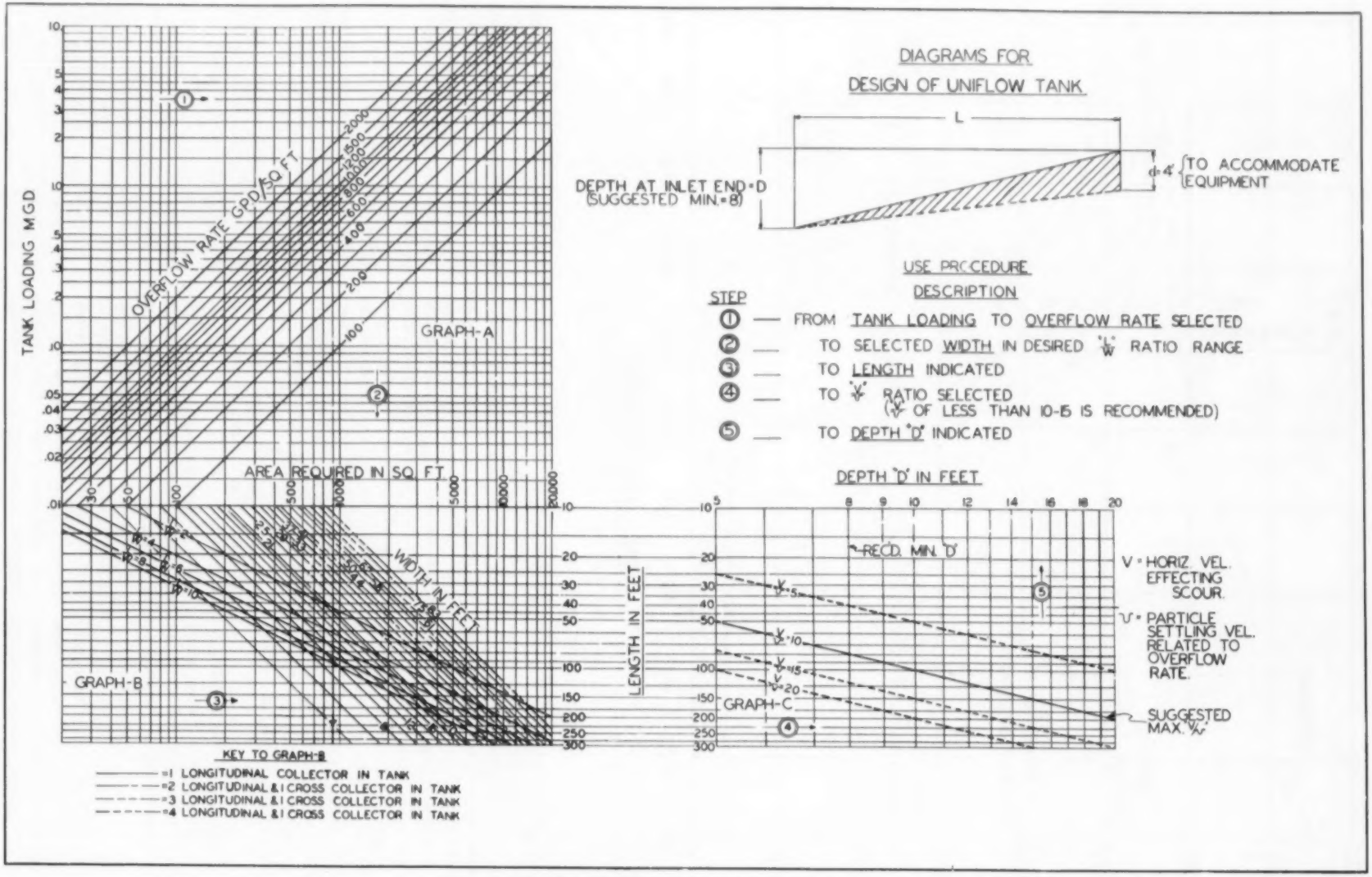
DIAGRAMS FOR
DESIGN OF UNIFLOW TANK
L
DEPTH AT INLET END = D
(SUGGESTED MIN. = 8')
TO ACCOMMODATE EQUIPMENT
USE PROCEDURE
STEP
DESCRIPTION
1 — FROM TANK LOADING TO OVERFLOW RATE SELECTED
2 — TO SELECTED WIDTH IN DESIRED "L/W" RATIO RANGE
3 — TO LENGTH INDICATED
4 — TO "V/v" RATIO SELECTED
("V/v" OF LESS THAN 10-15 IS RECOMMENDED)
5 — TO DEPTH "D" INDICATED
TANK LOADING M.G.D.
OVERFLOW RATE GPD/SQ FT
GRAPH-A
AREA REQUIRED IN SQ. FT.
WIDTH IN FEET
GRAPH-B
LENGTH IN FEET
DEPTH "D" IN FEET
RECD. MIN. "D"
GRAPH-C
V = HORIZ. VEL. EFFECTING SCOUR.
v = PARTICLE SETTLING VEL. RELATED TO OVERFLOW RATE.
SUGGESTED MAX. "V/v"
KEY TO GRAPH-B
=1 LONGITUDINAL COLLECTOR IN TANK
=2 LONGITUDINAL & 1 CROSS COLLECTOR IN TANK
=3 LONGITUDINAL & 1 CROSS COLLECTOR IN TANK
=4 LONGITUDINAL & 1 CROSS COLLECTOR IN TANK

DIAGRAM A—Design of Uniflow Tank.

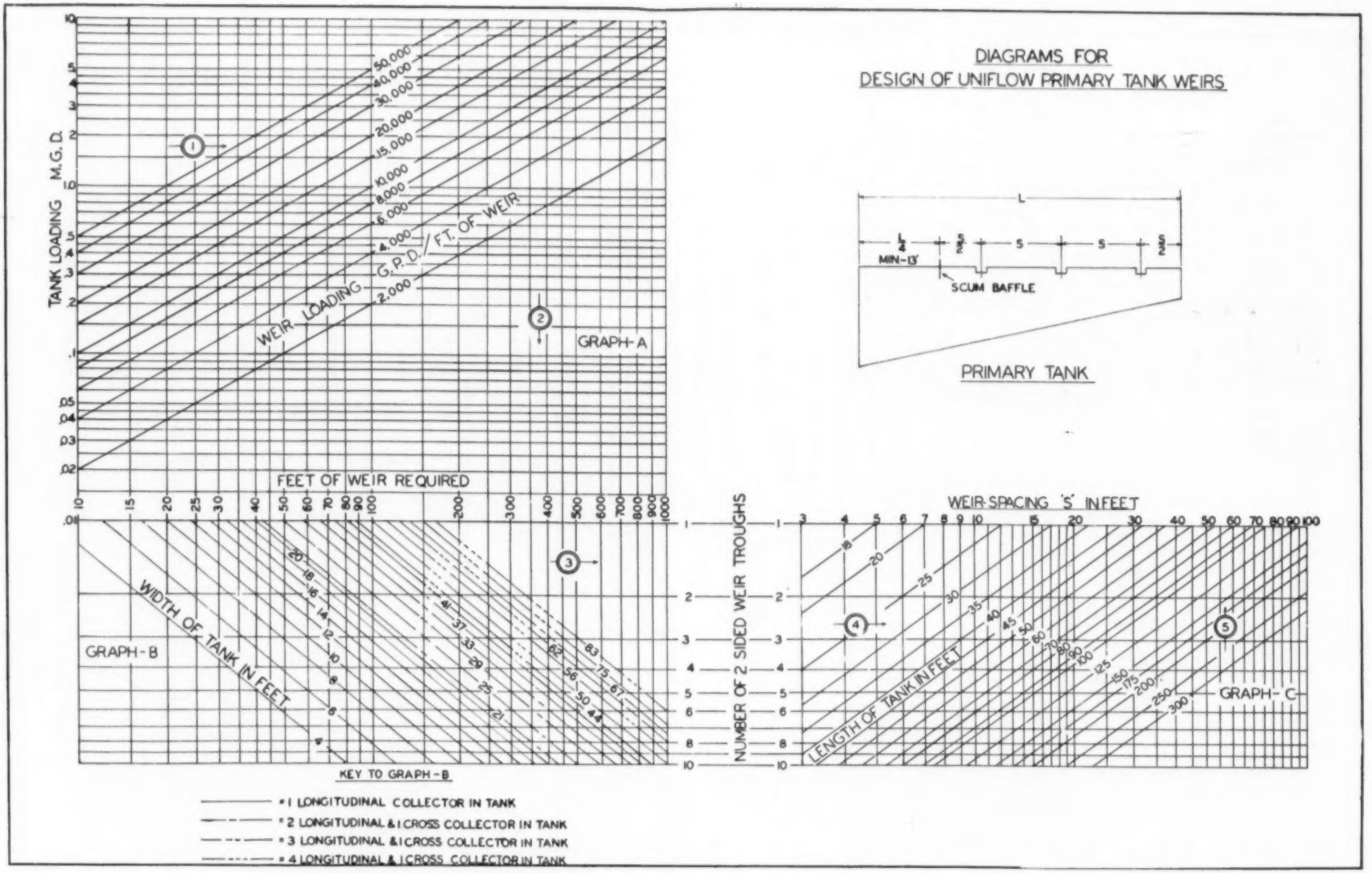

DIAGRAM B—Uniflow Primary Tank Weirs.

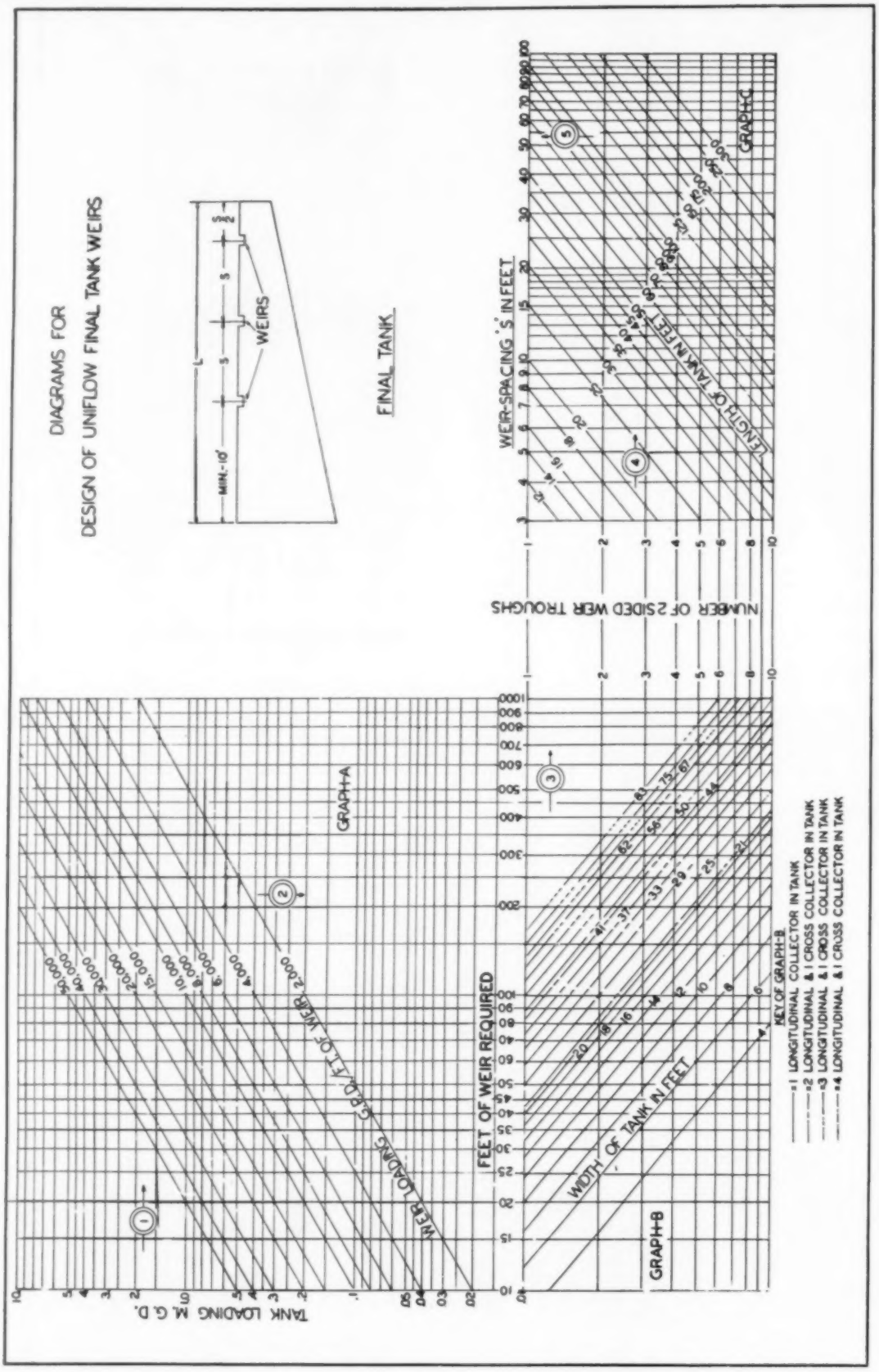
DIAGRAMS FOR
DESIGN OF UNIFLOW FINAL TANK WEIRS
FINAL TANK
WEIRS
MIN.-10'
GRAPH-A
TANK LOADING M. G. D.
WEIR LOADING GALLONS PER FT. OF WEIR
GRAPH-B
FEET OF WEIR REQUIRED
WIDTH OF TANK IN FEET
GRAPH-C
WEIR-SPACING 'S' IN FEET
LENGTH OF TANK IN FEET
NUMBER OF 2 SIDED WEIR TROUGHS
KEY OF GRAPH-B
=1 LONGITUDINAL COLLECTOR IN TANK
=2 LONGITUDINAL & 1 CROSS COLLECTOR IN TANK
=3 LONGITUDINAL & 1 CROSS COLLECTOR IN TANK
=4 LONGITUDINAL & 1 CROSS COLLECTOR IN TANK

DIAGRAM C—Uniflow Final Tank Weirs.

An evaluation of . . .

High-Rate Digestion

by CLAIR N. SAWYER, Prof. of Sanitary Chemistry, on leave, Division of Civil and Sanitary Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

RESUME: The development of high-rate sludge digestion is another step forward in the evolution of anaerobic digestion practice in which a serious attempt has been made to overcome certain limitations of the process. For purposes of definition, the high-rate process involves complete mixing of the primary tank contents on a continuous or intermittent basis to maintain a uniform mixture or "mixed liquor" condition in all parts of the digestion tank. Feeding may be on an intermittent or continuous basis but always with displacement of "mixed liquor" rather than supernatant liquor or sludge. Secondary units may or may not be involved as part of the digestion system.

In this article, the author states the fundamental concepts of high rate digestion and discusses loading parameters, detention time, limitations, and advantages of the process.

Dr. Sawyer concludes "High-rate sludge digestion is based upon sound fundamental principles and will become accepted practice in primary digestion for the majority of large installations. The process is rugged and not easily upset even when once daily feedings are practiced. A 10-day detention would seem to be a conservative basis of design, which would allow a satisfactory degree of degradation at the end of the design period."

The paper was presented at the Conference on Anaerobic Digestion at Manhattan College and is published here by permission.

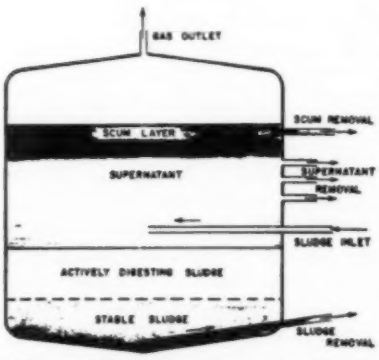

FIG. 1—Three separate layers normally are found in a conventional sludge unit.

■ OPERATION of heated digestion tanks has often been difficult due to the formation of scum layers which float on top of the liquid layer and suffer from poor thermal transfer, particularly in northern climates. Anyone who has conducted digestion studies on sewage sludge in glass containers has observed that freshly introduced solids will shortly rise to the scum layer and become part of it. This is the basis of the Laboon Process.[1] As decomposition proceeds in the scum layer there is a constant shedding of partially digested solids which fall to the bottom of the digestion unit and build up a layer of digested sludge. Thus, the early versions of anaerobic digesters involved three zones of activity as shown in Fig. 1. The scum layer constitutes a zone of primary decomposition where a majority of the gases are released, the sludge layer a secondary zone of decomposition, and a supernatant layer with dissolved and suspended matter which await transfer to other units for further purification.

As long as reasonably low loadings are imposed upon conventional units, such as those supplied to maintain 50 to 60 day detention periods, scum layers and high potency supernatant liquors are not a problem. As hydraulic or organic loadings are increased on such units, however, the need for means of controlling scum layers becomes imperative. Many schemes and devices have been employed for accomplishing this objective and still maintain the three zones in the digestion tank, usually with the production of a highly inferior quality supernatant liquor high in B.O.D. and suspended solids. The Pearth Process[2] is the latest of these schemes to be advanced and, undoubtedly, the most effective.

Fundamental Concepts

It is well recognized that the total environment is a fundamental consid-

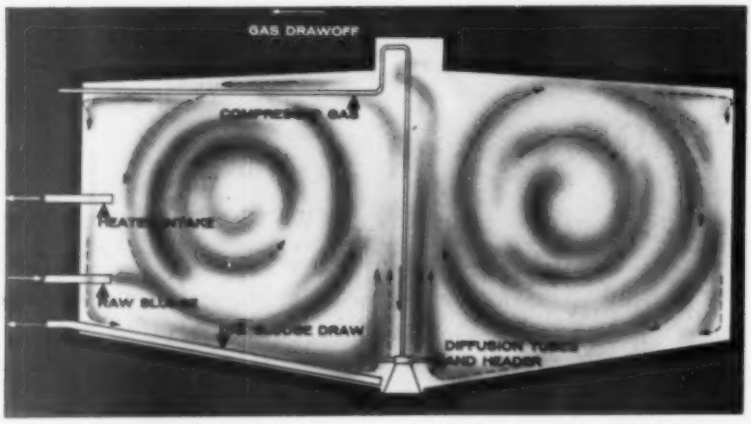

FIG. 2—The CRP high-rate digestion unit of Chicago Pump Co. utilizes mixing by gas recirculation.

eration in any biological process and that the limitations for satisfactory functioning of the anaerobic organisms responsible for producing methane are rather strict. Four of these factors which are difficult to control in conventional digestion units but are overcome in high-rate units are as follows:

Thermal Homogeneity — Conventional digestion units have serious thermal variations, particularly in the scum layer. This reduces the rate of decomposition materially and scum layers increase in thickness during cold weather to form an insulating cap. With the advent of warm weather, the stored load in the scum layer often causes a tank to become upset. Use of devices to maintain complete mixing prevents thermal stratification and "cold storage" of organic matter.

Biological Balance and Food Contact—It is common knowledge that two groups of organisms work hand-in-hand to destroy organic matter and produce methane. The saprophytic organisms reproduce rapidly and under a wider range of environmental conditions than the methane forming bacteria. The former tend to predominate in scum layers because the methane formers are lost in significant numbers as digesting sludge particles "shed" from the scum layer to the sludge layer below. As a result digestion in the scum layer is always on a restricted basis, while the sludge layer which has plentiful numbers of methane formers has a limited food supply.

Complete mixing of tank contents keeps the saprophytic and methane organism populations well mixed and in contact with the food supply at all times.

Solids — Water Ratio — There is growing evidence that destruction of organic matter by the usual organisms for the purpose of producing methane is restricted by too high a solids concentration[3] or more likely too low a water content to adequately dilute the biochemical end products. Such a condition conceivably occurs in the sludge layer of a conventional digester and could be a major consideration in scum layers where solids concentrations often approach 15 per cent. Complete mixing, of course, prevents development of such localized conditions.

Loading Parameters

There is no sharp line of demarcation between conventional and high-rate digester loadings. Residence or detention time is undoubtedly the proper way to express loadings, since digester behavior and character of the end products appear to be more closely related to detention time than organic loadings[4]. Operation of digesters as high-rate units allows either higher solids loadings per unit volume or shorter periods with freedom from the usual upsets because of more efficient use of the space provided.

Methods of Maintaining High-Rate Digestion

Since maintenance of a digestion unit on a high-rate basis simply involves agitation by some means to keep the entire contents uniformly mixed, the methods by which this can be accomplished are few. Up to the present time only three schemes have been proposed.

Gas Recirculation—The first system proposed for maintaining the contents of a digester in constant turmoil involved compression of gas evolved from the sludge with subsequent release through a diffuser located near the bottom of the tank. Such a system was developed by the Chicago Pump Co. and is marketed under the name of "CRP" Process. Figure 2 shows the details of such an installation. With recirculation of adequate volumes of gas, scum formation can be completely controlled and a "mixed liquor" condition maintained. The PFT "Pearth" System of scum control is shown in Fig. 3.

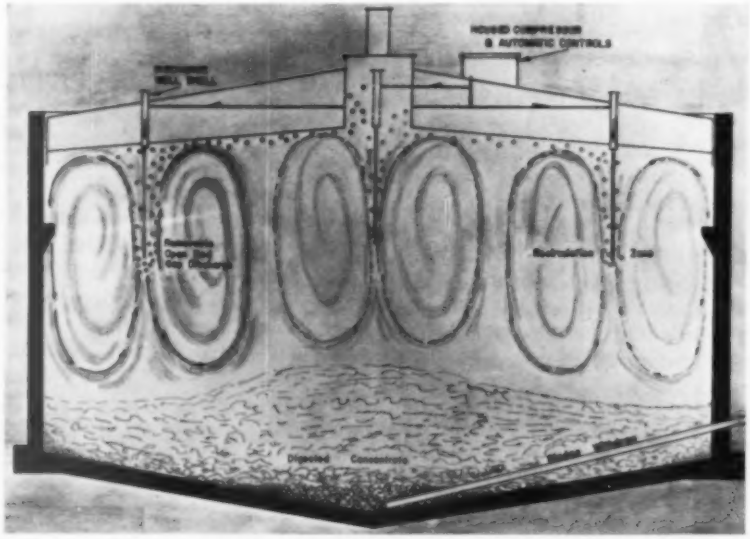

FIG. 3—Gas recirculation in the scum layer is the feature of the PFT-Pearth Sequential Multipoint System.

Mechanical Mixing — Mechanical mixing devices were pioneered by the Dorr-Oliver Co. and have been used in many installations for satisfactory control of scum problems. Early designs made no attempt to keep the entire contents of the digestion tank mixed and allowed segregation of digested sludge in the bottom of the tank. The latest designs, however, provide for discharge of the draft tube mixers tangentially across the bottom of the tank for the purpose of keeping the entire contents of the digester well mixed. Figure 4 shows the detail of the Dorr-Oliver system.

Torpey[5] employed external recirculation of digestion tank mixtures but concluded that internal mixing facilities were more efficient and practical.

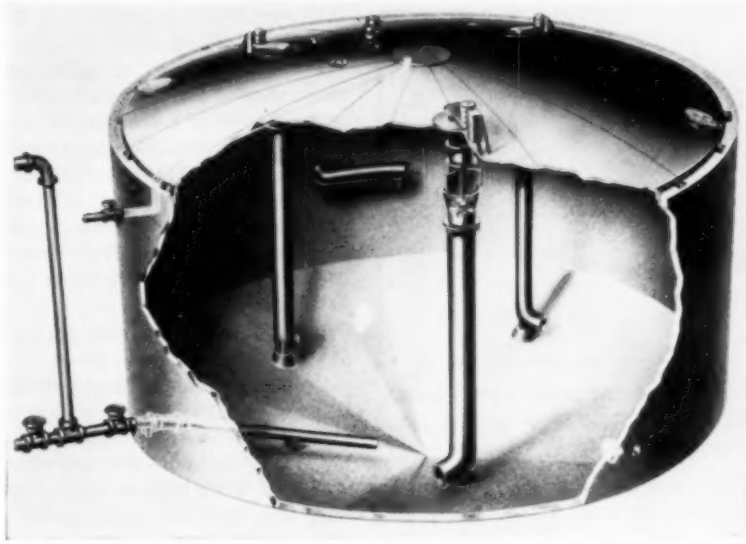

FIG. 4—Mechanical mixing is used in Dorr-Oliver system.

Detention Time

Rankin[6] was the first to point out the fact that residence or detention time of digesting material is the best parameter for evaluating the behavior of a digestion system and the character of the product produced. Following a study of the operating records of nearly 50 digester installations, he summarized his findings from 17 of the plants graphically as shown in Fig. 4. These data were obtained from installations treating a wide variety of sludges and release of this information probably "triggered" the development of high rate systems.

The 26th annual meeting of the Federation of Sewage and Industrial Wastes Associations held in Miami, October 1953, was a momentous occasion for those interested in sludge digestion. Two papers on high-rate digestion were presented. Morgan[7] reported on laboratory and pilot plant studies in the range of 7 to 12 days detention, showing stable operation of the pilot unit over a 10 month period with detention periods ranging from 7.2 to 11.8 days. Torpey[8] presented information on plant scale studies which showed that satisfactory digestion could be maintained with detention periods ranging from 11 to 15 days. His studies were conducted with pre-thickened sludges but without adequate facilities for maintaining a "mixed liquor" condition throughout the digester.

Schmidt[4] conducted laboratory scale high-rate digestion experiments to study the relationship between concentration of solids in sludge fed to diges-

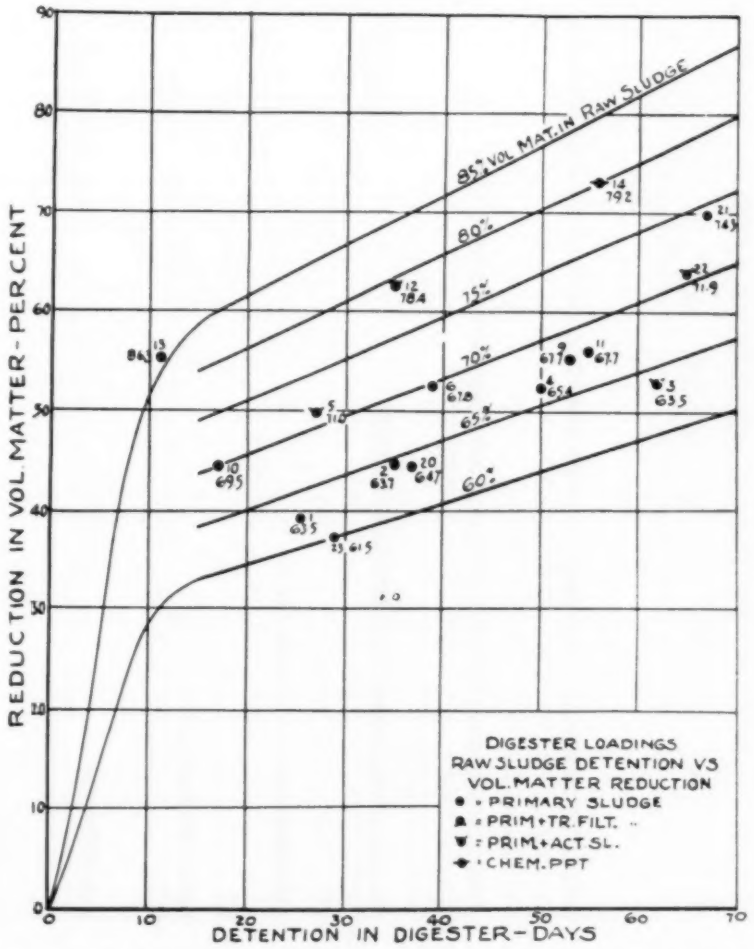

FIG. 5—Relationship between raw sludge detention and volatile matter reduction. (After Rankin[6].)

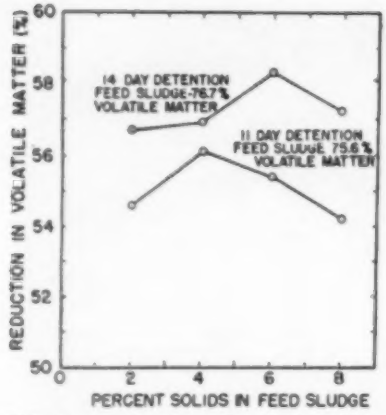

FIG. 6—Destruction of volatile solids versus time.

tion units and detention time. His experiments at 11 and 14 day detention were successful. Volatile solids destruction as shown in Fig. 6 were essentially independent of solids loading and a direct function of detention time. His results support the original thesis advanced by Rankin[6].

Torpey,[5] through a pilot plant study, showed that high-rate units can be maintained in a condition of stable operation at detention times as low as 3.2 days. Attempts to shorten the detention time further met with process failure. Roy[9] was unable to establish digestion on a 5-day detention basis but was successful with a six-day holding time.

If detention time is the parameter of major concern in the design of digestion units, it is a natural corollary that the size of units for a given situation will decrease in direct ratio to the increase of solids in the feed sludge. Although it has been recognized for a long time that feeding of as dense a sludge as possible is desirable, the full import has been realized only since the development of high rate units. With a high-rate unit operating on an 8 to 10 day detention basis, the capacity requirements are immediately cut to 1/5 of those needed for conventional design of 40 to 50 days detention. With adequate prethickening of sludge, the volume requirements may be reduced to about ⅛ of the normal.

Limitations

The need for maintaining a "mixed liquor" condition in a high-rate digester is the major cause of shortcomings of the process. Because of this factor, the mixture leaving the digestion unit for disposal is essentially the same as that left behind in the unit. Thus, the discharge is in an actively digesting condition and contains a significant fraction,

$$\frac{1}{t},$$

of sludge of residence time of 1 day or less depending upon the mode of feeding (t = theoretical detention

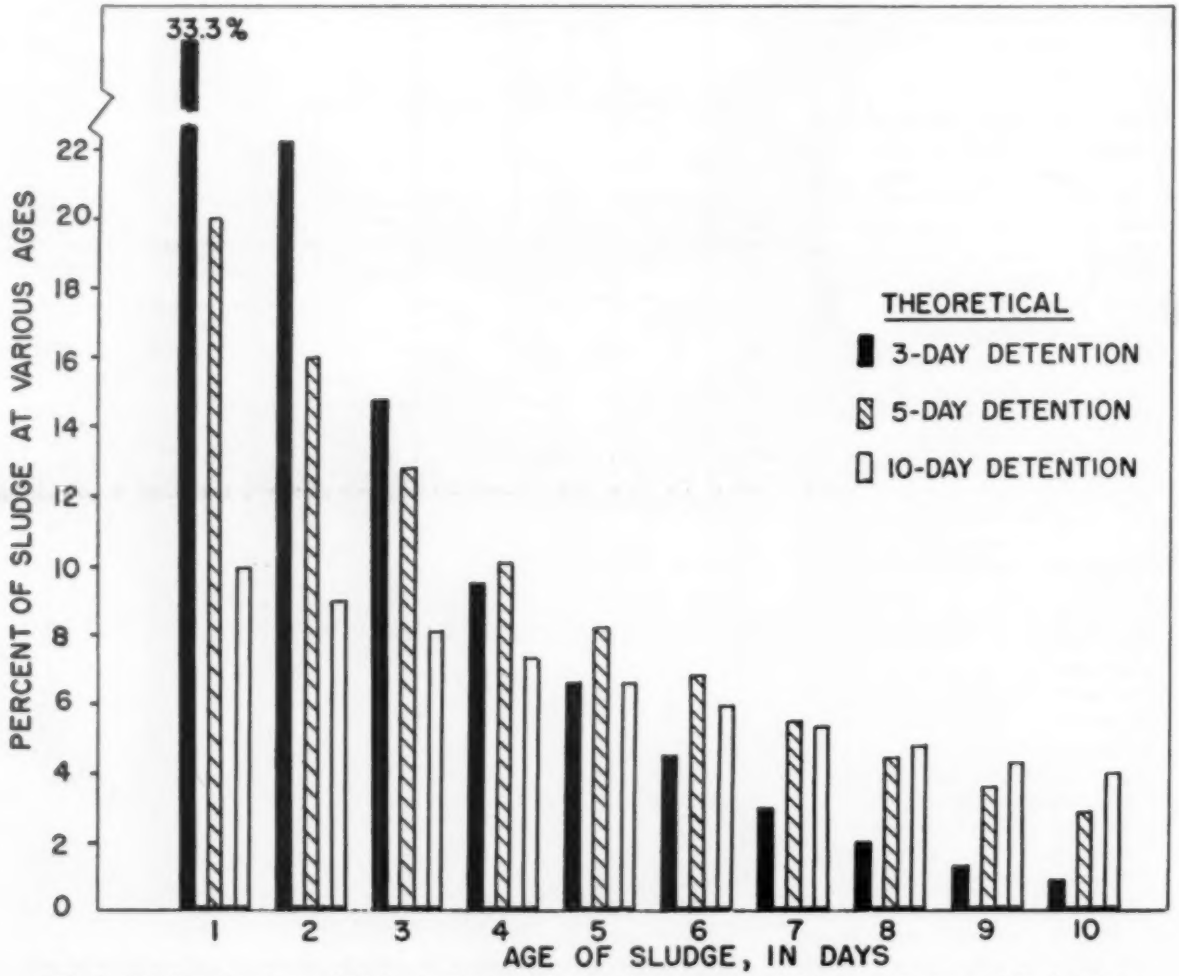

FIG. 7—Relationship of age of sludge to detention time as discharged from high-rate units (once daily feeding).

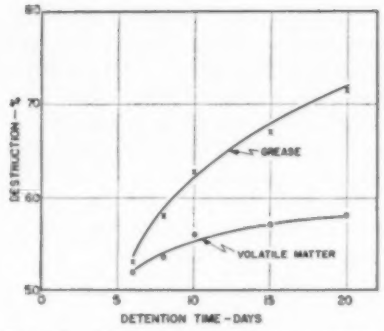

FIG. 8—Destruction of organic matter by digestion.

time in days). For a digester operating on a once daily feeding basis, the fraction of sludge or any age contained in the discharge may be determined by application of the general formula

$$\times = \frac{1}{t}\left(\frac{t-1}{t}\right)^{n-1}$$

where n = whole days. The compaction of the sludge mixture withdrawn from the digester or remaining in it may be expressed as follows:

$$\text{Composition} = \frac{1}{t} + \frac{1}{t}\left(\frac{t-1}{t}\right)^{1} + \frac{1}{t}\left(\frac{t-1}{t}\right)^{2} + \text{etc.}$$

or, for those who prefer a higher order of mathematics, the following expression may be adopted:

$$C = C_o e^{-Kt}$$

where $C_o = 1$, the original concentration, C = the fraction remaining at any time, t, and K is a constant which varies with detention time but is easily evaluated.

The age distribution of sludges discharged from high-rate digesters with respect to detention time is shown in Fig. 6. From this it can be noted that when the detention time falls significantly below 10 days, the amount of short residence solids which escape become a large part of the total. The data as plotted are for once daily feedings and as feedings are made more often the situation becomes even worse.

Fundamentally, successful operation of a high-rate digestion unit depends upon producing a product which can be disposed of satisfactorily with the facilities provided and without too much sacrifice of gas yield. The studies conducted by Torpey[5] and by Roy[9] give us considerable information to serve as a basis of evaluation. The data are particularly valuable because of the similar character of the sludges used, averaging 74.5 per cent volatile solids in each case. Roy's work was conducted using a twice daily feeding schedule, while Torpey fed his unit on a continuous basis. Roy's data were obtained on 5 digestion units operated in parallel at 6, 8, 10, 15 and 20 day detention periods and, probably, offers a more valid basis of evaluation. Roy[10] continued operation of his units on a once daily feeding schedule for an additional 10 month period.

Destruction of Organic Matter—The major function of any digestion system should be destruction of organic matter. Results obtained by Roy given in Table 1 show a marked regression in destruction of organic matter, as measured by volatile solids, as detention time was decreased below 10 days. Even more dramatic was the regression in grease destruction as shown in Fig. 8. Destruction of protein matter seemed to correlate well with the volatile solids data. On the basis of these data, it appears that grease destruction is the major factor which limits high-rate sludge operation and, where sewage sludges are involved, the minimum detention time is in the order of 5 days.

Gas Production—The factor of second greatest importance in sludge digestion, where gas is used for power production, concerns the volume and quality of the gas produced. The data given by Torpey[5] and Roy[9] show a surprising similarity. Carbon dioxide content of the gases produced was of the same order for like detention periods, ranging from 34.0 to 37.9 per cent. Gas production data, Fig. 9, shows that a significant decrease in volume per unit of volatile matter charged to the digester accompanied a decrease in detention time but the volume per unit of volatile matter destroyed was essentially a constant. Torpey's data indicates a greater sacrifice of gas production with decreased

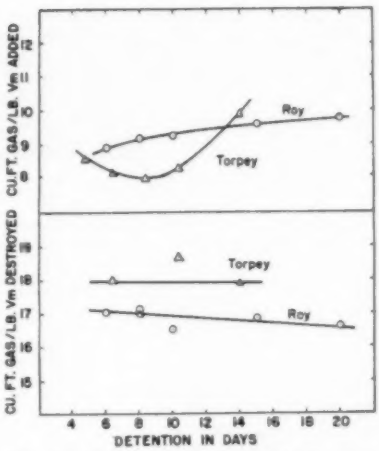

FIG. 9—Gas production—Volatile matter relationships (from Torpey[5] and Roy[9]).

detention time than does the data of Roy. This may have been the result of continuous feeding by Torpey which would allow a greater percentage of poorly digested solids to escape. Roy reported a yield of methane at 6 days detention corresponding to about 88.8 per cent of that produced at 20 days detention. This value corresponds very well with a volatile matter destruction of 89.6 per cent at 6 days compared to that produced at 20 days.

Separation of Grit—Mixing of digester contents by means of gas recirculation accelerates the separation of any heavy inorganic matter which is contained in the sludge. Removal of displaced mixture through the usual sludge draw-off line is required to prevent accumulation of grit which might clog such lines if they are not used regularly.

Starting High-Rate Units—Most high-rate units have been placed in operation by seeding heavily with digested sludge from other units, consequently, very little information ex-

Table 1

Destruction of Organic Matter

(75-Day Period)

	Detention Period in Digester, Days				
Volatile Matter	6	8	10	15	20
Per Cent	52.2	53.5	55.8	57.2	58.2
Per Cent of 20-Day	89.6	91.8	95.8	98.3	.....
Grease					
Per Cent	53.0	57.8	62.4	67.1	71.4
Per Cent of 20-Day	74.2	80.8	87.4	94.0	.....
Indicated Protein Destruction (Per Cent of 20-Day)	86.0	89.8	93.2	99.7	.....

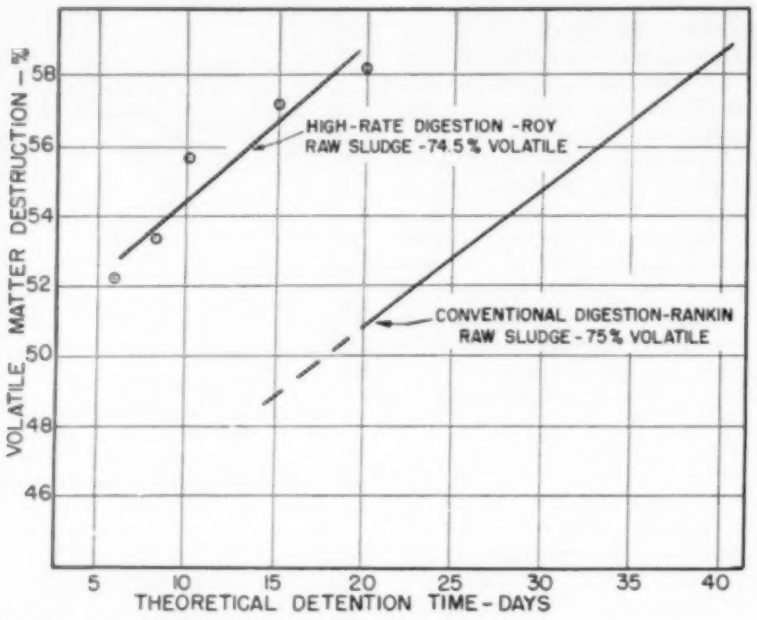

FIG. 10—Comparison of volatile matter destruction in conventional versus high-rate digestion (from Rankin[8] and Roy[9]).

ists on how to start a high-rate digester in the absence of seeding matter. Where seeding matter is not available, it is conceivable that considerable quantities of sludge will have to be disposed of by other means until the digestion units are brought into normal operation. In some instances this could mean the by-passing of the major part of the sewage flow for a period of several weeks.

Survival of Pathogens—Digested sewage sludge leaves much to be desired from the standpoint of hygienic quality. In view of the data shown in Fig. 7, it would seem logical that a significantly greater number of the pathogens will escape in the discharge from a primary digester operated on a high-rate basis than would be the case where intimate mixing is not practiced.

Langley[11] has investigated the survival of *S. schottmuelleri* and *S. typhosa* in high rate units operated in parallel at 6 and 20 days detention. He found 7.5 and 6.7 per cent survival, respectively, of the organisms after one day in the digester operated at 6 days detention and a .40 and .22 per cent survival, respectively, of the organisms after one day in the digester operated at 20 days detention. This would seem to verify the hypothesis that hygienic quality will deteriorate rapidly as detention time is reduced. However, in a study involving the feeding of sludge enriched with *S. typhosa* over a 24 day period, the sludge from the 6 day detention digester contained only 2.36 times as many surviving organisms as were found in the sludge from the 20 day detention unit. No studies were conducted on the more resistant forms such as *B. tuberculosis, E. historlytica, Ascaris* eggs or helminth ova.

Mechanical Failure—Cessation of mixing for any prolonged period will allow formation of serious scum layers. If such scum layers are allowed to consolidate, difficulty will be encountered in disrupting them when agitation is renewed. When dispersal is accomplished, the "stored" load may cause the process to become upset. It is imperative that reserve facilities be available for making quick repairs.

Sludge Disposal—There are so many methods employed for sludge disposal that general comments would not necessarily apply to all situations. The following conditions seem worthy of mention:

Disposal by Barging to Sea—The "mixed liquor" withdrawn from high-rate units will normally require dewatering in some degree for economical disposal.

Disposal by Dilution with Final Effluent—The solids contained in the discharge from short detention high-rate units have two characteristics which may make them unsuitable for such disposal. The latent gasification potential may give rise to sludge bank formations which rise to the surface and the relatively high grease content may be a cause of sleek areas.

Disposal on Sand Beds—Due to the short term of digestion to which a significant portion of the solids are subjected as detention time falls below 6 days, it is possible that sufficient easily digested material may carry through to support fly and rodent populations.

Disposal by Vacuum Filtration—Since the "mixed liquor" discharge from a high-rate digester contains all the soluble biochemical end-products of digestion (mainly alkalinity), chemical conditioning for vacuum filtration would not be practical without elutriation. It is to be expected that considerable difficulty would be encountered in washing such an active sludge so as to produce a reasonable quality of elutriate and a sludge dense enough for good vacuum filter operation. Operation of vacuum filters could be complicated to some extent by the relatively high grease content. Further digestion and dewatering in secondary units would seem to be indicated before attempting vacuum filtration.

Problems of Secondary Digestion—Considerable experience has been accumulated on the operation of secondary units serving highly loaded primary tanks. The principal problems have been related to scum formation and inability to withdraw a satisfactory supernatant liquor. In other words old problems of primary digesters have been transferred to some extent into the secondary units. The solution to the problem would seem to lie in increasing the detention time of the primary units or providing the secondary units with some means of scum control.

Advantages

Capital Costs—It is estimated that capital costs of primary tank installations can be reduced to about 25 per cent of those needed to provide conventional treatment.

Heat Conservation—Heat losses

will be reduced in almost direct relation to the surface area of the structures.

Process Stability—Stable operation of primary facilities normally insures the stability of the complete digestion system.

Acceleration of Solids Destruction—Maintenance of a uniform, favorable environment throughout the digestion tank allows digestion of solids to progress unhindered at all times. Thus, a given degree of volatile solids destruction is obtained in a much shorter time in a high-rate digester than in the conventional type. This is shown by comparing data of Roy[9] with those developed by Rankin[6] as shown in Fig. 10. For sludges of about 75 per cent volatile matter, Roy showed a volatile solids destruction in 20 days equal to that obtained in 40 days in conventional digesters and a volatile solids destruction in 6 days equal to that obtained in about 23 days in conventional systems.

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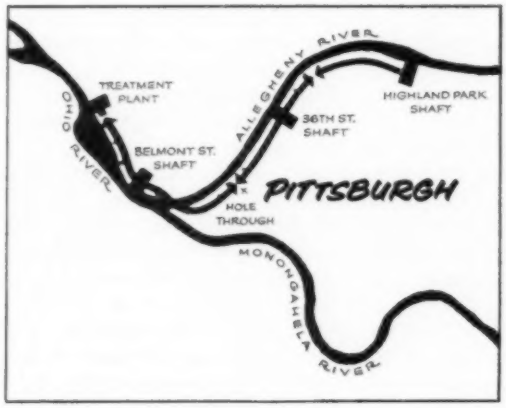

MAP of the main trunk sewer tunnel and "holing through" celebrations illustrate that another major milestone has been reached in the . . .

Allegheny Sewage Disposal System

Allegheny County Sanitary Authority sewage disposal system has now linked two principal segments of the sewer tunnel running along the Allegheny River 100 feet beneath downtown Pittsburgh.

Workmen, driving upstream from the Point and downstream from the 36th Street access shaft, have "holed through" at a point almost directly below Tenth Street.

The tunnel now extends from about 55th Street to a point less than half a mile above the Authority's sewage treatment plant just above the McKees Rocks Bridge. Less than a quarter mile separate crews driving up from 36th Street and down from the Highland Park access shaft.

To reach the "holing through" point required driving through solid rock almost two miles from 36th Street and above 1.6 miles from the Belmont Street shaft in Manchester. Yet measurements showed the two segments of the 10-foot-diameter tunnel to be only ⅜-inch out of alignment and ⅛-inch off the specified grade.

Dravo contracts, which account for nearly 19 million of the $80-million cost of the complex interceptor sewer system, include completion of ten miles of tunnel, 58 downshafts and diversion structures, and five river crossings.

The main interceptor, which will consist of pre-cast concrete pipe inside the tunnel, will vary in size from 48-inch diameter at Highland Park to 126 inches between Belmont Street and the treatment plant. Maximum diameter between 36th Street and the Point will be 72 inches.

In all, the Sanitary Authority's system will include more than 63 miles of interceptor sewers, serving municipalities throughout the county.

In respect to fundamental research studies, there is still much to be done on . . .

Anaerobic Digestion

According to R. RUPERT KOUNTZ and JOHN B. NESBITT, respectively Professor and Asst. Prof. of Sanitary Engineering, Pennsylvania State University, University Park, Pa.

EDITOR'S NOTE: This article deals with the subject from the standpoint of the bacteria, rather than from that of the engineer or chemist as such it presents an interesting concept of an aerobic digestion. The article* was presented as a paper at the 2nd Waste Treatment Conference, held at Manhattan College in New York City.

■ ANAEROBIC DIGESTION has not received its proportionate share of fundamental research in the field of waste treatment. As a result, the accepted criterion of its optimum performance has been gas production rather than the destruction of organic material. Until the work of Schroepfer[8] little thought was given to comparing its mechanism with the mechanism involved in the activated sludge process.

Some reports in the literature suggest hopes of isolating a methane-producing culture, and in comparison similar searches are reported for an "activated sludge organism," but without avail. The aerobic or anaerobic bio-mechanisms are accomplished by a flora composed of many species participating in an integrated "assembly line" type of decomposition. Each particular species thrives and participates in a definite stage of the metabolism process wherein it produces a single definite chemical change.

Biological decomposition (aerobic or anaerobic) is accomplished for only one purpose—propagation of the species. Therefore, the decomposition must yield both energy and chemicals for cell synthesis. If any component necessary to produce these two essentials is absent, no decomposition will occur. Limiting the concentration of a necessary component will reduce the system metabolism rate and the basic efficiency of the process.

The aerobic activated sludge process obviously requires the mechanical addition of a metabolic component; that is, oxygen. The anaerobic digestion process appears to have an identical counterpart in that it might require the addition of carbon dioxide for use as a hydrogen acceptor. Therefore, as in activated sludge treatment, it would appear most beneficial to recycle an excess of carbon dioxide gas, along with complete inter-mixing, to provide the most opportune conditions.

The various species in the flora grow and assimilate substrate when their particular chemical is available; therefore, they will be in a resting stage when their chemical is absent. If their particular chemical appears in large concentrations at widely-spaced time intervals they will metabolize it by going through first a lag phase, then a growth phase, and finally returning to the original resting phase. To eliminate this sequence of phases, the major portion of which is non-productive, it is obvious that a uniform feeding rate of the original substrate would keep all of the species in the growth phase continuously. This makes the most efficient use of the flora, and therefore the most efficient digestion process.

Maxon[5] has shown that the most efficient biological decomposition occurs when the unit throughput rate is equal to the growth rate of the flora. Harris[4] found that the growth rate was proportional to the concentration of the flora, and could easily be raised to the nearly theoretical maximum. Thus, when the flora concentration is high (due to a short detention time) the throughput rate of the substrate will be equal to the growth rate of the flora species, providing none of the environmental conditions restrict the metabolism. The substrate will be converted to new flora and inorganic byproducts, and if not removed the new flora will be assimilated eventually by its own and other species. Thus a maximum equilibrium concentration can be maintained in the digester.

The foregoing theories indicate several factors which should be considered in the analysis, design, and operation of an anaerobic treatment unit. These factors (namely, loading, mixing, and carbon dioxide) are necessary to provide the proper environment for the maximum exploitation of the biological activity of the microorganisms.

The loading of any biological treatment unit should be based on the "treatment opportunity" of the organic matter entering the system. This treatment opportunity depends on the weight of organic matter entering the system, the weight of microorganisms available to metabolize this organic matter, and the rate at which the organic matter is metabolized. Present loading factors consider organic matter as weight of volatile or total solids added per day, and the rate of biological metabolism is indirectly expressed as the detention time. Generally, how-

*Published here with permission of Manhattan College.

ever, no logical units have been employed to measure the weight of microorganisms available.

Considering the successful application of weight of mixed liquor suspended solids to measure this quantity in the activated sludge process, the same parameter could be used for anaerobic treatment processes. Thus, a logical loading parameter might be weight of volatile solids (in the substrate) per unit time, per weight of digestion tank suspended solids per unit detention time. This loading is similar to the one proposed for activated sludge in the NRC report.[7] The principle of this parameter has been applied to anaerobic treatment by Schroepfer[8]; when his data were plotted similarly to the NRC parameter an acceptable correlation was obtained.

Complete mixing of substrate and microorganisms is another important factor required to produce the maximum treatment opportunity. Schroepfer,[8] Torpey,[9] and Morgan,[6] have all shown how mixing increases the efficiency of digestion. Such an increase is logical, because mixing provides the maximum opportunity for physical contact between substrate and flora.

Carbon dioxide, unintentionally supplied by digester gas recirculated to provide mixing, has been shown by Morgan[6] to be valuable in providing treatment opportunity and thus increasing digester loading capacity. However, little thought apparently has been given in sanitary engineering research to the role of carbon dioxide in anaerobic metabolism.

Barker, Ruben, and Kamen[3] by using radioactive carbon (C^{11}) in their CO_2 have shown conclusively that one well-known methane producer, *Methanobacterium omelianski*, can use CO_2 as its sole source of carbon in the formation of methane. This reaction is:

$$4H_2A + CO_2 = 4A + CH_4 + 2H_2O$$

Barker[1] in further studies showed that the substrate, H_2A, in this equation may be either primary or secondary alcohols, but not methanol, tertiary butanol, fatty acids, or glucose. The primary alcohols were oxidized to fatty acids and the secondary alcohols to ketones, with CO_2 in each case acting as the hydrogen acceptor. In an attempt to determine if other hydrogen acceptors could be substituted for CO_2, Barker found that oxygen and nitrate were toxic, sulfate was inert, and formic acid could be used only with ethanol also present. Thus, it was concluded that none of these substances could substitute for CO_2 as a hydrogen acceptor. Similar studies showed that *Methanosarcina methanica* could oxidize methanol and acetic acid to produce methane by employing CO_2 as the hydrogen acceptor.

Barker[2] also studied the influence of CO_2 concentration on the rate of reaction of molecular hydrogen and CO_2 by means of *Methanobacterium omelianski*. The reduction occurred as follows:

$$4H_2 + CO_2 = CH_4 + 2H_2O$$

and the reaction rate varied directly with the increase in CO_2 concentration. Further experiments were made in which the CO_2 concentration was held constant and the pH varied, but the reaction rate remained constant, thus indicating that the CO_2 concentration and not pH was the controlling factor in the reaction rate.

Barker's experiments do not necessarily prove the primary role of CO_2 in methane prouction in a sewage sludge digester. They do, however, provide food for thought in future research and in the analysis of existing data.

In a recent controversy, many investigators and operators reported that the judicious use of lime can improve digester operation by increasing its buffer capacity. However, these same people have found that excess lime or lime added suddenly can be harmful. Perhaps Barker's research provides an answer to this problem in view of the familiar reaction of CO_2 and the hydroxide ion, as follows:

$$CO_2 + Ca(OH)_2 = CaCO_3 + H_2O$$

which inhibits anaerobic metabolism by reducing or removing the essential carbon dioxide.

It is believed to be possible to develop a "digestion" system for sewage and wastes which will be truly "anaerobic activated sludge," as Schroepfer entitled it. Such anaerobic activated sludge treatment probably would require less than 24-hr (instead of 720-hr.) detention and would be agitated by recycling CO_2 gas (part of which could be obtained by burning the process methane liberated) at the same rates as are now employed in aerobic activated sludge treatment. The substrate would be fed continuously at a uniform rate from a holding tank. The flora in the effluent would be separated and returned to the influent to be mixed with the substrate.

This anaerobic activated sludge process truly would be economically designed to decompose concentrated organic waste, not empirically designed and inherited.

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And, I warned Joe about lighting matches down there!

The Scranton Publishing Co., Inc., is pleased to introduce . . .

New Staff Members *and Contributing Editors*

PUBLISHER'S NOTE: Continuing our efforts to improve the service our magazines render, we have acted to expand our editorial department, by adding two regular staff members and four contributing Editors. Jay S. Grumbling has joined the staff as Associate Editor and T. J. Conway as Assistant Editor, both will work on *Water & Sewage Works* and *Industrial Wastes*. The four new Contributing Editors who have become associated with the editorial staff of *Water & Sewage Works* are Paul D. Haney, Dr. Ross E. McKinney, Robert C. Merz, and Rolland W. Simpson. Four editorial associates of long standing, John R. Baylis, L. L. Hedgepeth, C. E. Keefer, and A M Rawn, will continue to serve as Contributing Editors.

Jay S. Grumbling, Associate Editor, is a graduate of Virginia Military Institute with a B.S. in Civil Engineering; and an S.M. degree in Sanitary Engineering from Massachusetts Institute of Technology in 1955.

For the past six years, Mr. Grumbling has served as a First Lieutenant in the United States Air Force, as a Sanitary and Industrial Hygiene Engineer. Two of those years were spent as a graduate student at MIT. Other service locations include Scott Air Force Base, Ill.; Wheelus Air Base, Tripoli, Libya; Weisbaden, Germany; Izmir, Turkey; Gunter AFB, Ala.; Olmstead AFB, Penna.

Mr. Grumbling's responsibilities during his service included advice and assistance as a member of the Surgeons Staff, on engineering aspects of preventive medicine, aviation medicine, military construction, and research and development. His duties under these responsibilties included surveys, design of controls, maintenance of surveillance over hazardous environmental conditions involving physical, chemical and biological agents, covering the specific areas of water supply, waste disposal, swimming pools, housing, noise control, food service sanitation, base planning, illumination, air conditioning, ventilation, industrial air pollution, and ionizing radiation.

Mr. Grumbling served at the supervisor or base level, consultant or staff level and as an instructor in the fundamentals of Sanitary Engineering. He worked in cooperation with the United States I.C.A., U.S.O.M. projects in Tripoli, Libya, and in Egypt. His work in epidemiological studies in North Africa and the Middle East resulted in association with both staff and field personnel of WHO, Food & Agricultural Organization, UNESCO, and UNICEF. During the course of his service, he travelled in nearly all of the NATO nations, as well as Africa and the eastern half of the USA.

Mr. Grumbling has authored the following papers: "The Exposure to Methanol from the Spirit Duplicating Process" (S.M. Thesis); "Sound Level Studies Conducted at Spangdanel Air Base"; "Pollution of Boundary Sea Waters, Wheelus Air Base, Libya" and "Sanitary Survey, Adana Air Base, Turkey."

Mr. Grumbling is a Junior Member, ASCE; and a member of Am. Soc. of Mil. Engrs.; Conf. of Federal Sanitary Engineers; AWWA, FSIWA, and the Society of Sigma Xi.

Fred C. Maurer, Associate Editor, was promoted to that position on January 1 of this year. Prior to that time he had been Assistant Editor of WATER & SEWAGE WORKS, since 1951, and Assistant Editor of INDUSTRIAL WASTES since its inception in 1955.

Before joining WATER & SEWAGE WORKS, in 1950, Mr. Maurer, was employed by the Public Relations Firm of John D. Whitmore, handling one of the principal accounts, The Woburn Chemical Corp. During this period, he wrote technical articles for *Chemical Engineering, American Paint Journal, India Rubber World,* and other journals covering application of the compay's basic chemicals in these fields. He also prepared a complete series of Technical Bulletins on the company's products, and directed a Voice of America broadcast based on the company's chemical plant as being typical of the chemical industry in the United States.

Thomas J. Conway, Assistant Editor, has had experience in business paper and house organ editing, public relations and business and newspaper writing. Mr. Conway studied journalism at Columbia University and New York University. He has worked for the Lighthouse for the Blind and Pan American World Airways where he was editor of their Traffic and Sales publication, "Sales Clipper."

As Assistant Editor on our staff, Mr. Conway will handle production editing and the preparation of news stories on equipment, manufacturers' personnel and new bulletins and catalogs.

Paul D. Haney, a Sanitary Engineer on the staff of Black and Veatch in Kansas City, Mo., is a graduate chemical engineer from the University of Kansas, with an M.S. degree in Sanitary Engineering from Harvard University.

Mr. Haney worked with the sanitary engineering division of the Kansas State Health Dept. for a number of years, and was Chief Sanitary Engineer of that State from 1942-47. He was then Associate Professor of Sanitary Engineering at the University of North Carolina for 1½ years before joining the U. S. PHS in 1948 as a commissioned engineer officer in the regular corps. He was stationed at the Robert A. Taft Sanitary Engineering Center in Cincinnati, where he was in charge of water pollution control studies. In 1954 he joined the staff of Black and Veatch.

Mr. Haney is a registered professional engineer in Kansas and Missouri. He is a diplomate in the American Academy of Sanitary Engineers, and belongs to AWWA, FSIWA, NSPE, Kan. Eng. Soc. and Mo. Wat. & Sew. Conf. Currently, he is Chairman of the Water Purification Division of AWWA and Vice Chairman of the Publications and Program Committee of FSIWA. In 1955, Mr. Haney received the AWWA Goodell Prize and the Water Purification Division Award.

Ross E. McKinney, Associate Professor of Sanitary Engineering at Massachusetts Institute of Technology, is a graduate of Southern Methodist University with a B.A. degree in mathematics and chemistry and a B.S. in Civil Engineering (both in 1948). He also holds S.M. and Sc.D. degrees in Sanitary Engineering from Mass. Inst. Tech.

Dr. McKinney has done outstanding work in the field of microbiology and biochemistry of liquid organic waste treatment and has authored thirty technical papers on studies in these fields.

He has been on the faculty at MIT for the past five years and for two years prior he was Acting Head, Dept. of Sanitary Science, at the Southwest Foundation for Research and Education in San Antonio, Tex. Prior to his teaching assignments, he was a Research Assistant and member of the DIC staff at MIT, doing work on sanitary engineering microbiology and radioactivity. He is a member of the Cambridge (Mass.) Water Board, and Vice Pres. of R. Eliassen Associates, Inc. Dr. McKinney is a member of ASCE, AWWA, Boston Soc. Civ. Eng.; ASEE, FSIWA, Soc. Am. Bact., and APHA.

Contributing Editors

By adding four new Contributing Editors to the four editorial associates of long standing, we not only have an excellent advisory board, but also eight men of professional standing who will contribute special material and features to our pages. Messrs. Baylis, Hedgepeth, Keefer and Rawn are well known to our readers. Here are thumbnail sketches of the professional accomplishments of our new associates.

Robert C. Merz, Professor of Civil Engineering, University of Southern California, is a graduate civil and sanitary engineer with a B.S. and M.S. from the University of Wisconsin.

Prof. Merz, who is also a director of Sanitary Engineering Research at U.S.C., has been teaching since 1948, first at the Univ. of Wisconsin and then at U.S.C., where he was elevated to present position in 1956. Prior to 1948, Prof. Merz was associated with the Chain Belt Co. in Milwaukee, Wis., where he supervised estimating, preparation of specifications and engineering design and assisted in research and development of new products and processes.

Prof. Merz is a registered professional engineer in the State of Wisconsin and a diplomate in the American Academy of Sanitary Engineers. He is a member of ASCE, AWWA, FSIWA,APHA, Sigma Xi and Chi Epsilon. He has served as a member of the Executive Committee on Revision of Water Treatment Plant Design Manual of ASCE, and Vice Chairman, Advisory Committee on Sanitary Engineering to the California State Dept. of Health.

In May of this year, Prof. Merz went to Sweden at the invitation of the Royal Academy of Engineering Service to present a lecture at the conference staged by the Academy. He also spoke at the Water Hygiene Assn. Conf. Oreboro, and at the technical institutes in Stockholm and Gothenburg.

Rolland W. Simpson, Chief Sanitary Engineer, Gilbert Assoc., Inc., Consulting Engineers, Reading, Pa., holds a B.S. and M.S. from Canisius College, Buffalo, N. Y., the latter degree having been obtained in Sanitary Engineering Chemistry.

Prior to his present association, Mr. Simpson was a civilian sanitary engineer with the Corps of Engineers and Air Force from 1942 to 1946, and for six years before the war he was Associate Chemist of the Buffalo (N. Y.) Sewer Authority.

In his present capacity, Mr. Simpson has supervised report preparation, design, and construction of nearly 300 projects for water, sewage and industrial waste treatment. During the war he supervised the operation of water and sewage plants at Army and Air Force Bases in the south. At Buffalo, Mr. Simpson was engaged in laboratory control and research in connection with the design and operation of the Bird Island Sewage Treatment Works.

Mr. Simpson is a licensed professional engineer in Pennsylvania, Delaware, and Maryland. He is a member of AWWA, FSIWA, TAPPI, and NSPE. He is County Civil Defense Technical Division Chairman, and is Borough Councilman in his hometown. He has authored or co-authored 40 articles on the field of water, sewage and industrial waste treatment.

The Editor's Comments

Conserving Our Water Resources——I

In April, I had the pleasure of speaking on this topic at the 6th Annual Pennsylvania Clean Streams Conference sponsored by the Penna. State Chamber of Commerce. What I said there, I'd like to repeat and therefore I shall devote this page to the subject both this month and next.

What is conservation?—Webster says it is the "protection from harm, loss or from being used up," especially as applied to human or natural resources. This definition is basic to my thesis, as is the first law of thermodynamics known as the conservation of energy. This law states that the total energy in this world is a constant value. With Einstein's classic equation, $E = cm^2$, it became apparent that mass and energy are only different measures of the same thing and therefore the law of conservation of energy is simply another form of the law of conservation of mass which says that "matter can neither be created nor destroyed, only changed."

Thus from thermodynamics, we can understand that the total amount of water on the earth and in its atmosphere is a constant quantity. For all practical purposes, we can not create more water than has existed throughout the earth's history—and we can not destroy it—BUT we certainly can destroy its usefulness, and have been doing so, for decades.

We have been destroying our water resources by over use; by causing loss by land cultivation and consequent destruction of covering vegetation, which holds water; and by harming our surface and ground water supplies.

We know that in the continental United States, alone, the average yearly rainfall is more than 4300 billion gallons a day. We know, too, that our use of water in this country is increasing. How rapidly that increase is, and has been taking place, is indicated by data developed by the Water and Sewage Industry Utilities Division of the U. S. Dept. of Commerce, as shown in this table.

Billion Gallons of Water Used Per Day

Year	Public Water Supply	Industry Steam & Electric Power		Irrigation	Total
1900	3	10	—	—	40
1940	10	29	22	71	135
1950	14	46	38	100	203
1960 (Est)	22	72	77	135	312
1975 (Est)	30	115	131	170	453

How far we are going to go in water demands is indicated by the estimates for 1960 and 1975. In support of these estimates, data from 1955-56 indicated a public water supply consumption of 147 gpcd, a population growth rate of 3 million persons a year, and an average gain each year of 1 gpcd consumption for public water supplies alone. At this rate, each year we must supply an additional 606 mgd of water to meet the growing demand for water from public water supplies. Harry E. Jordan, AWWA Secretary, has estimated that by 1975, the per capita water consumption for public water supplies will be 175 gal per day, and by the year 2000 A.D., it will be 200 gpcd. Hence the estimate of needs for public water supply alone in 1975 appears to be conservative, as no doubt are the other estimates. Another recent estimate for 1980 puts our needs at 600 bgd, mostly industrial.

The total water falling on the United States in a year seems large enough for all our needs but, unfortunately, two important factors adversely affect this reservoir from the sky and its availability for our use. First, of all the water precipitated on this country, approximately 72 per cent is lost to human use through evapo-transpiration; secondly, the western 60 per cent of this country receives less than 30 per cent of the total rainfall, while the eastern 40 per cent of the country receives 70 per cent of the total rainfall in the U. S.

Thus, while there is plenty of water for all possible uses of the future, we either can't hold it for our use, or it is not evenly distributed. These two factors greatly affect any plans we may have for conserving our water resources.

To these two factors can be added two more that have an extremely important bearing on the conservation of water resources. These are *Waste* and *Pollution* of available resources. The adage, "Waste not, want not" dates back perhaps centuries, but it is never outdated. To our sorrow, we are profligate in our waste of the water resources we have.

To waste is "to make poor use of, to spend uselessly, or to fail to get value from." How do we do this with respect to our water resources?—From the time water falls from the sky, we waste it by not storing it for our use, by not reducing the evaporation, by not using it efficiently in our industries, by letting it run to waste in our households, by inefficient leaky distribution systems. The amount of this wastage in industry and public water supplies, alone, is large enough to meet or offset our growing demands for the next decade, if not more.

The other important factor in conserving our water resources is the matter of pollution. Pollution, the act of defiling or making unclean and unfit for normal uses. Perhaps this may be the most important factor to be considered. We probably ruin more water every day than we actually use or need for all our uses, present and future. We ruin it by dumping into it, untreated or partially treated wastes from our cities and our industries. Just a few years ago, it was estimated that the pollution load on our water resources from municipalities was equivalent to 65 million persons, while the pollution load from industry (known and estimated) was equivalent to 85 million persons.

There have been great strides in the construction of municipal sewage treatment works in the past decade. Today, also, there is hardly an industrial manufacturing plant that has not heard of, considered, or installed industrial waste treatment processes. The fact remains, however, that we are scarcely keeping pace with our growing pollution load. That there is much yet to be done, is an understatement of major proportions.

These, then, are the important factors in our approach to conserving our water supplies. Next month, I shall discuss the several avenues leading to the solution of the problem.

George E. Symons.

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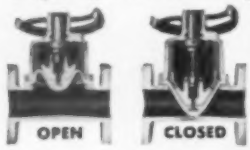

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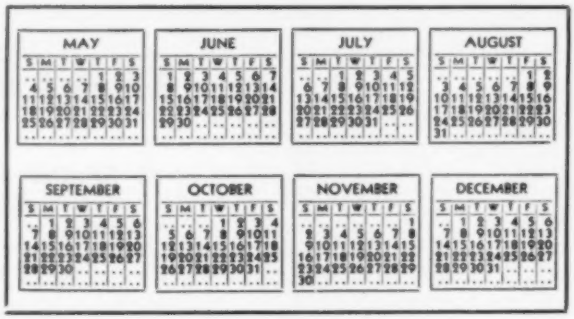


June 2-4—Toronto, Canada *(Royal York Hotel)*
CANADIAN SECTION, A.W.W.A., Secy., A. E. Berry, Ontario Water Resources, Parliament Buildings, Toronto, Ontario, Can.

June 2-6—University Park, Pa. *(Pa. University)*
WATER WORKS COURSE, Extension Conference Center, Pennsylvania State University, University Park, Pa.

June 4-5—Gardner, Mass. *(Colonial Hotel)*
NEW ENGLAND SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Earl R. Howard, 115 Broad St., Hartford 5, Conn.

June 4-6—Auburn, Ala. *(Ala. Polytechnic Institute)*
ANNUAL SHORT COURSE SCHOOL AND MEETING ALABAMA WATER & SEWAGE ASSN., Secy., E. J. Finnell, Univ. of Alabama, University, Ala.

June 12—Belfast, Maine
MAINE WATER UTILITIES ASSN., Secy., Gerard F. Laurin, 89 Western Ave., Augusta, Maine

June 12-13—Frederick, Md. *(Francis Scott Key Hotel)*
MARYLAND-DELAWARE WATER & SEWAGE ASSN., Secy., W. M. Bingley, 2411 N. Charles St., Baltimore 18, Md.

June 18—Swampscott, Mass. *(New Ocean House)*
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, 73 Tremont Street, Boston 8, Mass.

June 18-20—Toledo, Ohio *(Commodore Perry Hotel)*
OHIO SEWAGE & INDUSTRIAL WASTES TREATMENT CONFERENCE, Secy., Cleamon E. Lay, 301 Ohio Departments Bldg., Columbus 15, Ohio

June 18-20—Council Bluffs, Iowa *(Hotel Chieftain)*
IOWA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., L. F. Skorczeski, 207 South 15th Ave., Marshalltown, Iowa

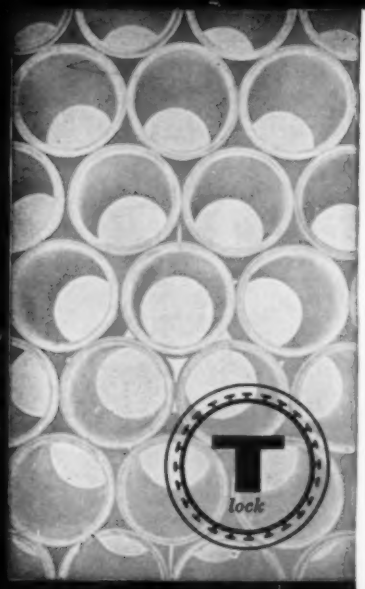
June 22-25—Philadelphia, Pa. *(Bellevue-Stratford Hotel)*
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, 50th Anniversary Meeting, Secy., F. J. Van Antwerpen, 25 W. 45th St., New York 36, N. Y.

June 23-25—Charlevoix, Mich. *(Charlevoix Beach Hotel)*
MICHIGAN SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Donald M. Pierce, Michigan Dept. of Health, Lansing 4, Mich.

June 23-27—Portland, Oregon *(Hotel Multnomah)*
AMERICAN SOCIETY OF CIVIL ENGINEERS, Exec. Secy., W. H. Wisely, 33 W. 39th St., New York 18, N. Y.

June 25-27—Erie, Pa. *(Hotel Lawrence)*
PENNSYLVANIA SECTION, A.W.W.A., Secy., L. S. Morgan, Div. Engr. State Dept. of Health, Greensburg, Pa.

Aug. 11-13—University Park *(Pa. University)*
PENNSYLVANIA WATER WORKS OPERATORS' ASSN., Secy., Harry A. DeWire, 29 Chestnut St., Lewistown, Pa.



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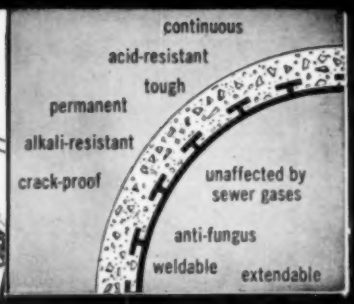

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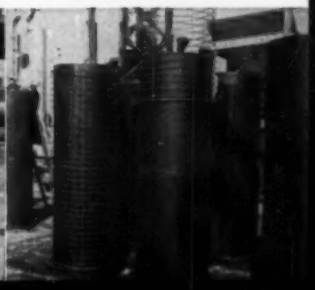

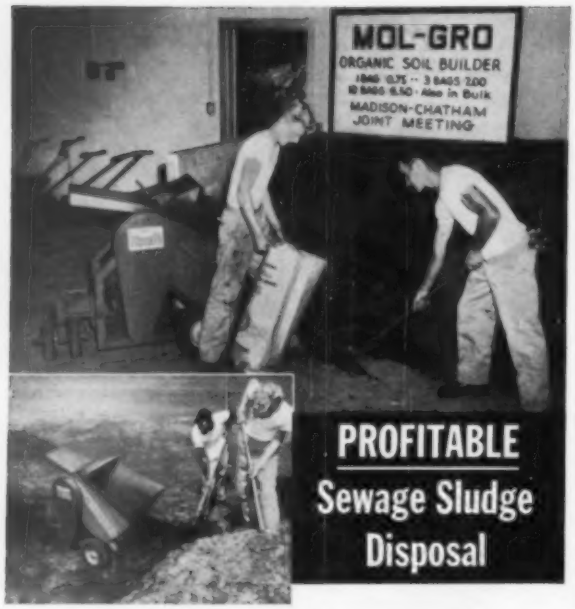

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Aug. 14—Millinocket, Maine
MAINE WATER UTILITIES ASSN., Secy., Gerard F. Laurin, 89 Western Ave., Augusta, Maine

Sept. 8-10—Grand Rapids, Mich. *(Pantlind Hotel)*
MICHIGAN SECTION, A.W.W.A., Secy., T. L. Vander Valde, Chief, Michigan Dept. of Health, DeWitt Rd., Lansing 4, Mich.

Sept. 10-12—Lake Placid, N. Y. *(Lake Placid Club)*
NEW YORK SECTION, A.W.W.A., Secy., Kimball Blanchard, 19 West 50th St., New York 20, N. Y.

Sept. 14-17—Poland Springs, Maine *(Poland Springs House)*
NEW ENGLAND WATER WORKS ASSOCIATION, Secy., Joseph C. Knox, N.E.W.W.A., 73 Tremont St., Boston 8, Mass.

Sept. 15-19—University Park, Pa. *(Pa. University)*
SEWAGE WORKS COURSE, Extension Conference Center, Pennsylvania State University, University Park, Pa.

Sept. 17-19—Cleveland, Ohio *(Statler Hotel)*
OHIO SECTION, A.W.W.A., Secy., J. H. Bass, Robert F. McGivern & Assoc., 1771 West Fifth Ave., Columbus 12, Ohio

Sept. 17-19—Wausau, Wis. *(Hotel Wausau)*
WISCONSIN SECTION, A.W.W.A., Secy., Harry Breimeister, City Engineers Office, City Hall, Milwaukee 2, Wis.

Sept. 17-19—Deadwood, S. D. *(Franklin Hotel)*
SOUTH DAKOTA WATER & SEWAGE WORKS CONF., Secy., Don C. Kalda, Pierre, S. D.

Sept. 22-24—Memphis, Tenn. *(Peabody Hotel)*
KENTUCKY-TENNESSEE SECTION, A.W.W.A., Secy., J. Wiley Finney, Jr., Howard K. Bell, Cons. Engrs., 553 So. Limestone St., Lexington, Ky.
(Jointly With)
KENTUCKY-TENNESSEE INDUSTRIAL WASTES & SEWAGE WORKS ASSN., Secy., S. Leary Jones, Cordell Hull Bldg., Nashville, Tenn.

Sept. 24-25—Stillwater, Okla. *(A & M College)*
OKLAHOMA INDUSTRIAL WASTES CONF., Secy., H. M. Crane, 3400 Northeastern, Oklahoma City 5, Okla.

Sept. 24-26—Dickinson, N. D. *(Ray Hotel)*
NORTH DAKOTA WATER & SEWAGE WORKS CONFERENCE, Secy., W. Van Heuvelen, Bismarck, N. D.

Sept. 28-30—Jefferson City, Mo. *(Hotel Governor)*
MISSOURI SECTION, A.W.W.A. AND MISSOURI WATER & SEWERAGE CONFERENCE, Joint Meeting, Secy., Warren A. Kramer, State Office Bldg., 6th Floor, Jefferson City, Mo.

Oct. 1-3—Dickinson, N. D. *(Ray Hotel)*
NORTH DAKOTA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Jerome H. Svore, c/o State Dept. of Health, Bismarck, N. D.

Oct. 5-9—Detroit, Mich. *(Sheraton-Cadillac Hotel)*
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSN., Ralph E. Fuhrmann, Exec. Secy., 4435 Wisconsin Ave., N.W., Washington 16, D. C.

Oct. 9—Bingham, Maine
MAINE WATER UTILITIES ASSN., Secy., Gerard F. Laurin, 89 Western Ave., Augusta, Maine

Oct. 13-17—New York, N. Y. *(Hotel Statler)*
AMERICAN SOCIETY OF CIVIL ENGINEERS, W. H. Wisely, Exec. Secy., 33 W. 39th St., New York 18, N. Y.

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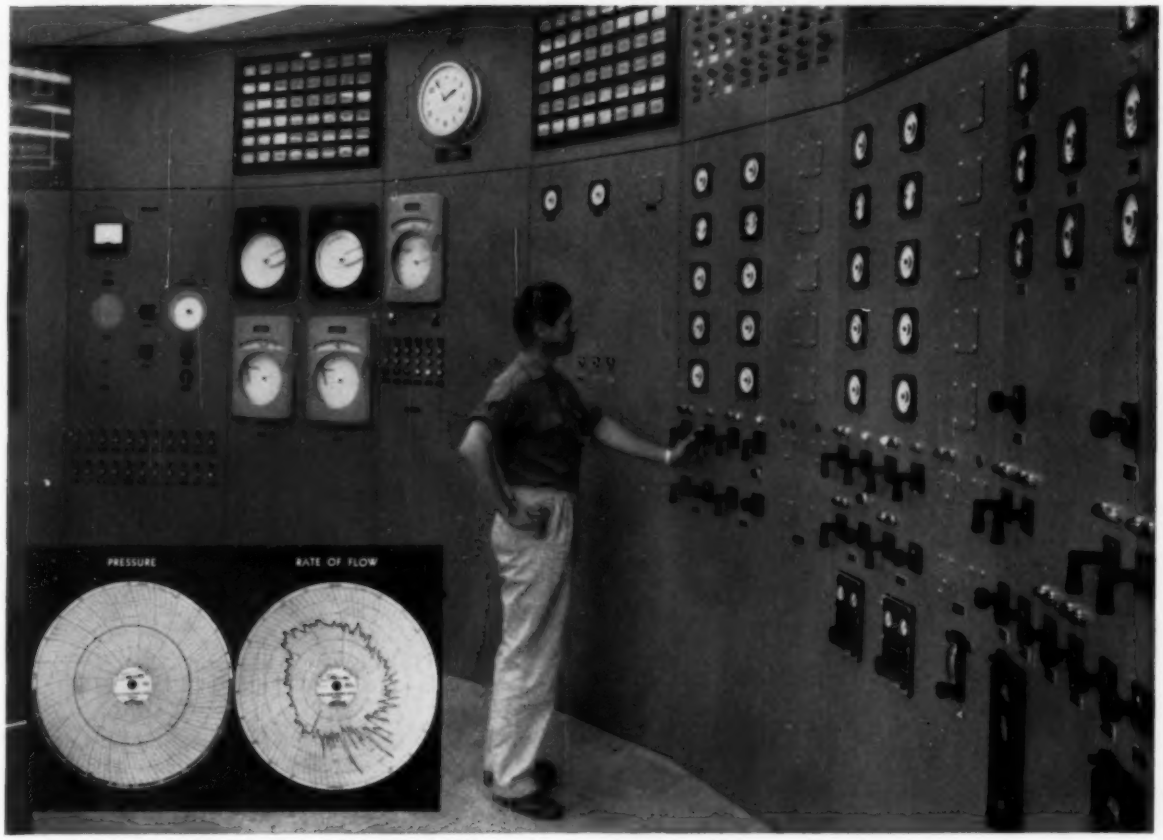

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IOWA SECTION, A.W.W.A., Secy., J. J. Hail, Supt., Water Dept., City Hall, Dubuque, Ia.

Oct. 19-22—Quebec City, Prov. Quebec *(Chateau Laurier)*
CANADIAN INSTITUTE ON SEWAGE & SANITATION, Dr. A. E. Berry, Administrative Office, 72 Grenville St., Toronto 8, Can.

Oct. 19-22—No. Miami Beach, Fla. *(Golden Gate Hotel)*
FLORIDA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Ralph H. Baker, Jr., State Board of Health, P. O. Box 210, Jacksonville 1, Fla.

Oct. 22-23—Charleston, W. Va. *(Daniel Boone Hotel)*
WEST VIRGINIA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Glen O. Fortney, State Dept. of Health, Charleston 5, W. Va.

Oct. 23-24—Charleston, W. Va. *(Daniel Boone Hotel)*
WEST VIRGINIA SECTION, A.W.W.A., Secy., Hugh W. Hetzer, Union Carbide Chemicals Co., Div. Union Carbide Corp., P. O. Box 8361, So. Charleston 3, W. Va.

Oct. 23-25—Atlanta City, N. J. *(Madison Hotel)*
NEW JERSEY SECTION, A.W.W.A., Fall Meeting Secy., Albert F. Pleibel, 683 Prospect St., Maplewood, N. J.

Oct. 27-29—Pittsburgh, Pa. *(Penn Sheraton Hotel)*
19th ANNUAL WATER CONFERENCE, Secy., W. M. Porter, Engineers' Society of Western Pennsylvania, Penn Sheraton Hotel, Pittsburgh 30, Pa.

Oct. 28-31—Los Angeles, Calif. *(Ambassador Hotel)*
CALIFORNIA SECTION, A.W.W.A., Secy., Roy E. Dodson, Jr., Supt. of Production, San Diego Water Dept., Balboa Park, San Diego 1, Calif.

Oct. 29-31—Wilmington, Del. *(Hotel Not Listed)*
CHESAPEAKE SECTION, A.W.W.A., Secy., Carl J. Lauter, 6955 - 33rd St., N.W., Washington 15, D. C.

Nov. 5-7—Richmond, Va. *(Jefferson Hotel)*
VIRGINIA SECTION, A.W.W.A., Secy., J. P. Kavanagh, Dist. Mgr., Wallace & Tiernan, Inc., 213 Carlton Terrace Bldg., Roanoke, Va.

Nov. 6-7—Lincoln, Neb. *(Lincoln Hotel)*
NEBRASKA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., V. J. Lechtenberg, 614 Standard Oil Bldg., Omaha, Neb.

Nov. 10-12—Greensboro, N. C. *(O'Henry Hotel)*
NORTH CAROLINA SECTION, A.W.W.A. AND NORTH CAROLINA SEWAGE & INDUSTRIAL WASTE ASSN., Joint Meeting, Secy., W. E. Long, Jr., State Stream Sanitation Comm., Raleigh, N. C.

Nov. 17-21—Stillwater, Okla. *(A & M College)*
OKLAHOMA INDUSTRIAL WASTES CONF., Secy., H. M. Crane, 3400 Northeastern, Oklahoma City 5, Okla.

Nov. 20—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, 73 Tremont St., Boston 8, Mass.

Dec. 7-10—Cincinnati, Ohio *(Netherland Plaza Hotel)*
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Annual Meeting, Secy., F. J. Van Antwerpen, 25 W. 45th St., New York 36, N. Y.

Dec. 11—Biddeford, Maine.
MAINE WATER UTILITIES ASSN., Secy., Gerard F. Laurin, 89 Western Ave., Augusta, Maine

Dec. 18—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, 73 Tremont St., Boston 8, Mass.

All internal parts, including the drain valve seat, are drawn through the top of the hydrant without disturbing the standpipe.

We can show you – right in your office – why Mathews dry-head construction is so important

No community can afford to take chances with its hydrants. They *have* to work—not just when they're new, but in every single emergency during the course of a long, long life. That's why the dry-head construction of the Mathews Flange Barrel Hydrant is so significant. It keeps sand and ice and sediment from accumulating and interfering with its instantaneous operation, a feature that can be highly important.

We can actually show you what we mean without even asking you to get up out of your chair. We'll bring our scale model to your office and disassemble it so that you can see its inner workings. Why not write us today and ask for one of our representatives to show you these important features.

Made by

R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe (centrifugally cast in sand molds)

News of Suppliers

Carpenter Elected President of Chain Belt

Chain Belt Co., Milwaukee, Wis., has announced that O. W. Carpenter has been elected President. He succeeds L. B. McKnight who has been President of the Company since 1953.

Carpenter came to Chain Belt in 1943 from Kearney & Trecker where he served as Secretary and Treasurer. His first assignment at Chain Belt was as Administrative Assistant at the firm's Ordnance Plant. In December 1947 he was elected Vice President in charge of Finance for the company. He was appointed a Director in 1948, and in 1954 was elected Treasurer in addition to being Vice President. In 1956 he assumed responsibility for the operation of the firm's Construction Machinery Section as Vice President-Construction Machinery and Finance. He was elected Executive Vice President in 1957.

ALWAYS-READY
GUARDIAN OF *LIFE*
AND PROPERTY

MH

COMPRESSION TYPE
FIRE
HYDRANT

Above: Standard Model.
Below: Traffic Model.

Although an M & H Fire Hydrant may stand idle for years, without a moment's notice it functions perfectly. Its simple rugged design and careful manufacture from highest quality materials is the reason.

Large diameter, unobstructed waterway gives high flow efficiency when large volume of water is needed to fight fire. All operating parts are bronze or bronze bushed. Furnished either in accordance with A. W. W. A. specifications or Underwriters and Factory Mutuals approved; also either standard model, traffic model or flush type. For complete information, address

M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

SUBSIDIARY OF W WALWORTH

Proportioneers "Micro Bus" to Tour U. S.

A Volkswagen "Micro Bus" is now touring the country to exhibit the line of feeders, filters, and proportioning equipment manufactured by Proportioneers, Inc., a division of B-I-F Industries, Inc., of Providence, R. I. The demonstration unit contains a miniature swimming pool and Cryst-L-Clear filter system, diaphragm feeders, steam meters, and proportioning pumps selected from the Proportioneers line. A small repair parts display and a number of bulletins on Proportioneers products complete the mobile exhibit.

During the next several months, this traveling showroom will visit Health Department Engineers, Water Purification Technicians, Consulting Engineers, and other Proportioneers customers for effective on-the-spot demonstrations all across the country. Visits may be scheduled by contacting the nearest Proportioneers field office.

Smith-Blair Promotes Ball

Smith-Blair, Inc., South San Francisco, Calif., has announced the appointment of R. A. "Dick" Ball as Southwest District Sales Manager. Mr. Ball will be located at Smith-Blair's new branch, plant, warehouse, and sales office in Henderson, Texas.

Mr. Ball, a native of the southwest, has been associated with Smith-Blair for several years, most recently as District Sales Manager, South Gate, Calif., branch.

Mr. Wesley von Woglom, formerly sales engineer, has been promoted to District Sales Manager, South Gate Branch succeeding Mr. Ball.

Hays Corp. Appoints Twible V.P.

The Hays Corporation, Michigan City, Indiana, has announced the recent appointment of Harlan Twible to the position of Vice-President, Manager of Marketing. Twible was previously Sales Manager of the Minneapolis-Honeywell Sales Office in Milwaukee, Wisconsin. A former Naval officer, Twible attended the University of Massachusetts and was graduated from the U. S. Naval Academy, Annapolis with a B.S. degree. He later graduated from the University of Chicago with an M.B.A.

CONTINUED ON PAGE 98A

Quiet Genie At Work...

F-M Submersible Pumps work silently below ground out of sight

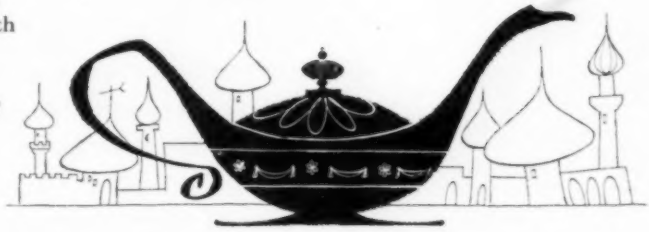
Working silently, deep in the earth, F-M submersible pumps supply millions of gallons of water each day for industries, municipalities, and communities throughout the world. Permitting well location anywhere a well can be drilled, F-M submersible pumps do away with unsightly installations and costly pump housing.

Submerged below water level, these pumps need no line shafts, packing boxes or lubrication equipment. Wearing parts... chief source of maintenance troubles...are reduced to a minimum.

Water Lubricated, Water Cooled... Built to Last by Fairbanks-Morse

The Fairbanks-Morse motor at the heart of the submersible pump has a lifetime Copperspun rotor cooled and lubricated by water. In combination with F-M—Pomona pump bowls, these wet stator motors give unbeatable pumping performance over a wide range of volume, depth and pressure requirements.

For full facts about community service or industrial use, see your F-M Sales Engineer or write for Bulletin 6910 today: Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago 5, Ill.



FAIRBANKS-MORSE

a name worth remembering when you want the BEST

PUMPS • SCALES • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY • RAIL CARS • HOME WATER SERVICE EQUIPMENT • MAGNETOS

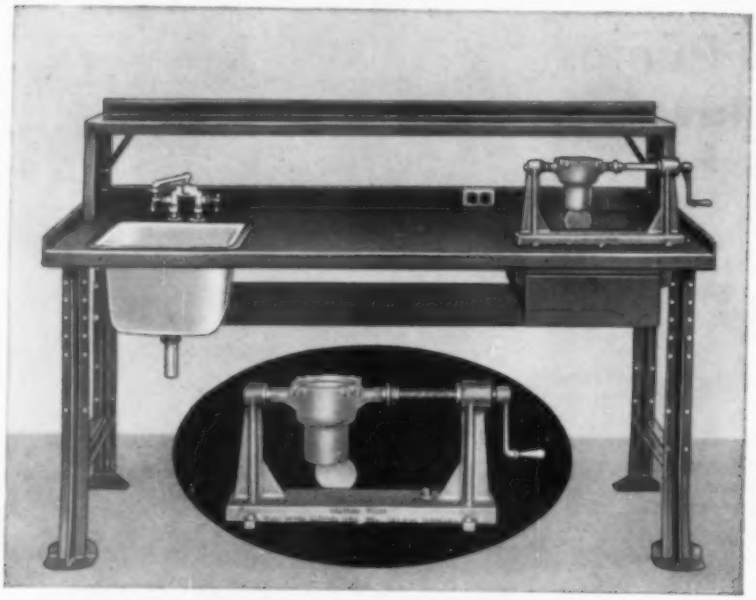
News of Suppliers

CONTINUED FROM PAGE 96A

Root-Connersville Expands Main Plant

Roots-Connersville Blower, Div. of Dresser Industries, Inc., has just completed a major expansion of its main plant. The new integrated manufacturing department, occupying 40,000 square feet, will be devoted exclusively to the production of type AF Rotary Positive Blowers, type XA Rotary Positive Gas Pumps and Rotary Positive Displacement Gas Meters. With the completion of the facility, manufacturing capacity for this equipment has been increased by 100%.

The most modern automatic metalworking machinery available has been installed to insure utmost precision in machining and assembly operations.



METER REPAIR BENCH . . .

Complete with Vise and Sink

Here is a repair bench designed specifically for the water meter shop. A 34" x 72" working top supports a 15" acid resisting sink, a meter vise that holds meters from ⅝" to 1" in size and a tool drawer. Above the bench is a shelf. Bench may be equipped with pressed wood top, two drawers or two shelves if desired. Electrical and air hose connections are standard equipment. Complete information gladly supplied.

Send for Ford Catalog No. 56.

FORD

FOR BETTER WATER SERVICES

THE FORD METER BOX COMPANY, INC. Wabash, Indiana

Peirson Joins Rhodia Alamask Division

Rhodia, Inc., New York, N. Y., has announced the appointment of Mr. Frank L. Peirson to its Alamask Odor Control Division in the Western District. Well known throughout Southern California in the field of sewage and industrial wastes, Mr. Peirson has represented the Los Angeles Chemical Company for ten years as a Sanitary Specialist.

Mr. Peirson is a member of the Board of Directors for the California Sewage and Industrial Wastes Association and past Chairman of the Local Section Committee. He has served as committee co-chairman on arrangements for the FSIWA recently held in Los Angeles, and he is a member of the Industrial Wastes Committee of California Manufacturers Association as well as on the Advisory Board of the Harbor Junior College in planning a Sanitary Engineering curriculum.

Allis-Chalmers Promotes Dineen

Allis-Chalmers Mfg. Co., Industries Group, Milwaukee, Wis., announced that Mr. R. J. Dineen, has been appointed manager, General Products Division sales, Central Region, with headquarters in Cleveland.

In his new position, Dineen will be responsible for the promotion, planning and coordination of sales and the achievement of sales objectives through the district offices for pumps, "Texrope" V-belt drive equipment, electrical control, and motors.

Dineen joined Allis-Chalmers in 1952. He is an electrical engineering graduate of the University of Cincinnati.

Taulman & Assoc. to Represent B-I-F in Southeast

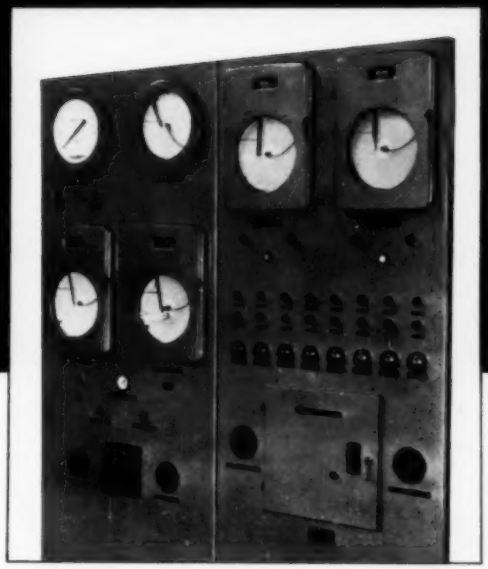
W. D. Taulman & Associates, of Atlanta, Ga., have been appointed exclusive Southeastern representatives of B-I-F Industries, Inc., and of the company's three Divisions—Builders-

CONTINUED ON PAGE 100A

POSITIVE CONTROL OF MATERIALS IN MOTION B·I·F METERS FEEDERS CONTROLS

Push One Button...

AUTOmatic
CENTRALized
Filter Operation



- Reduces Operating Costs!
- Reduces Operation Time!
- Eliminates Human Errors!

HERE'S HOW...

Builders Auto-Central® Filter Backwash Control Systems contribute to economical plant operation.

Pressing the "start" button initiates the backwash cycle. This automatically sequences the valves to drain filter . . . applies backwash and surface wash flows in precisely regulated quantities . . . and returns filter to service at end of cycle. A high speed recorder eliminates the need for log entries and computations. Thus operator is released for other more important duties . . . operating time and costs are reduced . . . human error is eliminated!

Other Builders Auto-Central advantages include:

- lower initial cost . . . more economical arrangement of physical plant.
- optimum filter operation . . . more accurate, precise control of filter backwash cycle . . . automatically.
- greater reliability . . . human error eliminated.

Builders ONE SOURCE – ONE RESPONSIBILITY combination of equipment, service and experience is always available to aid you in solving any water, sewage or waste treatment problem. Write for Bulletin 480-L1 . . . to **Builders-Providence, Inc., 350 Harris Ave., Prov. 1, R. I.**

BUILDERS-PROVIDENCE
DIVISION OF
B-I-F INDUSTRIES B·I·F METERS FEEDERS CONTROLS

News of Suppliers

CONTINUED FROM PAGE 98A

Providence, Inc., Proportioneers, Inc., and Omega Machine Co. The Taulman organization, which also has an office in Florida, has represented Builders-Providence and Omega in the water and sewage field for some time, and added Proportioneers to its representation on March 11, 1958. Now all three divisions will be represented in both the water and sewage and the industrial fields.

Richards Joins B-I-F in Huntington, W. Va.

B-I-F Industries, Inc., Providence, R. I., has announced that Mr. Paul H. Richards has been appointed a Sales Engineer with the Huntington Office. He will cover West Virginia sales of the company's extensive line of precision instruments and equipment for positive control of materials in motion.

Mr. Richards served in the Navy during World War II, and later did saleswork for Keasbey, Mattison & Co., and for C. I. Thornburg Co., Inc., where he sold B-I-F meters, feeders, and controls to industrial and municipal users. His appointment to the Huntington office comes after a brief period with the Pittsburgh offices of B-I-F.

American Water Softener Promotes Seitz

American Water Softener Co., Inc., Philadelphia, Pa., has announced the appointment of Robert L. Seitz as Vice President and Sales Manager. Seitz has had a wide experience in water conditioning. After graduating from Carnegie Tech, he joined Infilco Corp. as a service engineer, after which he went with Cochrane Corporation as Sales Engineer and correspondent, later joining American Water Softener Co. in charge of Philadelphia sales.

Si Bessen Joins T. H. Creears Corp.

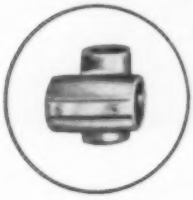
T. H. Creears Corp., Los Angeles, Calif., has announced that Si Bessen, formerly of Morristown, N. J., has joined its organization as a Sales Engineer. Mr. Bessen will specialize in sewage and industrial waste treatment applications of equipmen manufactured by Chicago Pump Company, Komline-Sanderson Engineering Corporation, E. B. Kaiser Company and Homestaed Valve Manufacturing Company.

A graduate of M.I.T., with a degree in Sanitary Engineering, Si served as an officer in the Corps of Engineers during World War II. For the past 11 years he has been engaged in sales engineering work with Chicago Pump Company, Oliver United Filters and Komline-Sanderson. A registered professional engineer in two states, Mr. Bessen's other professional affiliations include ASCE and FSIWA.

SEE HOW YOU CAN SAVE

when you build railings with

NU-RAIL® FITTINGS

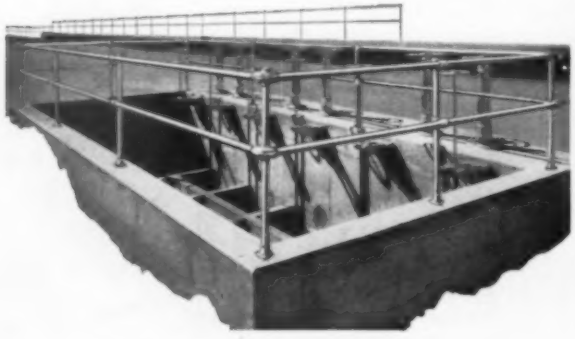


Eliminate threading and welding when installing railings and you can save real dollars. You'll save those dollars when you use specially-designed NU-RAIL Slip-On Fittings—the quick, easy and economical method of pipe fitting. On long runs, mill lengths of pipe can be used without cutting.

On a mile of railing built at this Texas sewage treatment plant the unique offset and slip-on features of NU-RAIL Fittings resulted in significant savings—up to 80% of labor cost.

For more money-saving ideas in railing construction write for Bulletin W.

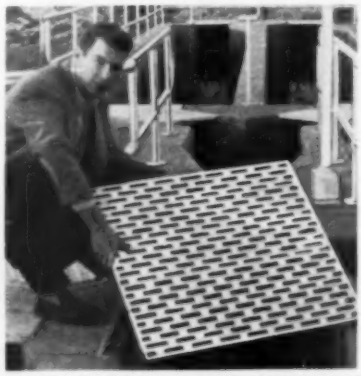
THE HOLLAENDER MANUFACTURING CO., 3841 Spring Grove Ave., CINCINNATI 23, OHIO



WACO ® T.M. REG. CANADA

ALUMINUM WALKWAYS ARE SAFE, MAINTENANCE-FREE

Non-Corrosive, Strong and Durable—They are Valuable Assets in Water and Sewage Plants



George H. Hill, Washington Aluminum's New England representative, points out the grating's patented perforation pattern.

Washington Aluminum Walkways ***provide*** a lifetime of maintenance-free service—never need painting, resist rust and corrosion, provide ventilation. Their strength lies in the I-beam extrusion.

Washington Aluminum fabricates grating and other installations to specification. Consult our Engineers at point of planning. . . . No charge — no obligation! . . . an engineering service of Washington Aluminum Company, Inc.

WASHINGTON ALUMINUM COMPANY, Inc.

Dept. 75 • Baltimore 29, Md. • Phone Circle 2-1000

Now Available – Crane A.W.W.A. Valves with "Ring-Tite"* and "Fluid-Tite"** Ends

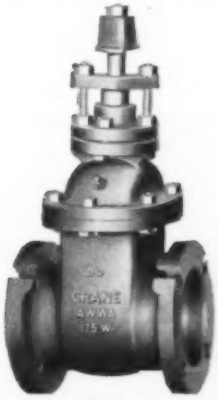
Two new Crane A.W.W.A. valves for use with asbestos-cement pipe —"Ring-Tite" and "Fluid-Tite"—are available in 3, 4, 6, 8, 10 and 12-inch sizes. These valves—added to Crane hub, flanged and mechanical joint end patterns—enable you to specify Crane quality for most A.W.W.A. valve installations.

More Advantages in Crane Quality

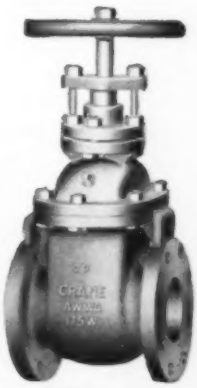
You can put Crane A.W.W.A. valves into service with no question of operating dependability when needed. They're engineered to give long-term trouble-free, maintenance-free service. Here are some of their advantages:

1. **Simple, 4-piece disc assembly and guide rib design—can't jam or become disengaged in service.**
2. **Trunnion-mounted rotating discs move freely . . . prevent wear on disc and seat.**
3. **Positive wedging action seats discs tightly**
4. **Non-binding ball-type gland and gland flange**
5. **Meet A.W.W.A. standard specifications**
6. **All patterns available either bronze-trimmed or with all-bronze internal parts with "Ni-Vee"‡ bronze stems**
7. **Choice of two types of stuffing boxes—with "O" ring seals or conventional packing**

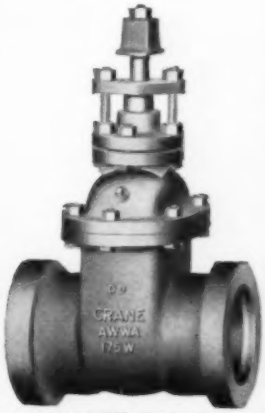
For complete details, ask your Crane Representative for information, or write to the address below.



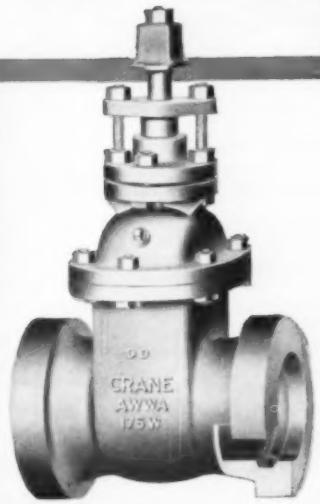
No. 480½ Hub Ends
Sizes†: 2 to 24-inch



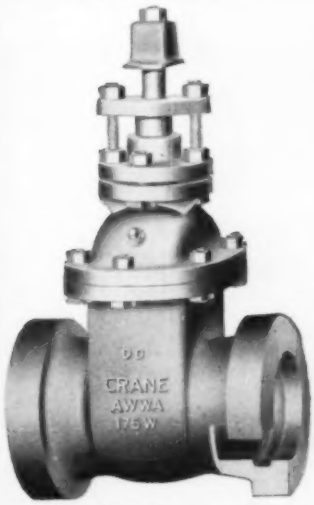
No. 2485 Flanged Ends
Sizes†: 2 to 24-inch



No. 2487½ Mechanical Joint Ends
Sizes†: 2 to 24-inch



No. 2482½ "Fluid-Tite" Ends—
Sizes: 3, 4, 6, 8, 10, 12-inch



No. 2482½ "Ring-Tite" Ends—
Sizes: 3, 4, 6, 8, 10, 12-inch

**Johns-Manville Asbestos Pipe*
***Keasbey-Mattison Asbestos Pipe*
† Excludes 5-inch size
‡"Ni-Vee" is a registered trade-mark of the International Nickel Co.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill.—Branches and Wholesalers Serving All Areas

GUNITE does it 2 times as fast at 1/2 the cost

"Gunite" is the modern process (sand and cement applied pneumatically) for repairing, constructing, lining:

- Reservoirs
- Dams
- Filter Plants
- Sewage Disposal Plants
- Tanks
- Stadiums
- Bridges
- Sea Walls
- Swimming Pools, etc.

Write FOR MORE INFORMATION, INCLUDING 48 PAGE "GUNITE" BOOKLET.

PRESSURE Concrete Co.

FLORENCE, ALA. 1555 Helton Street

OTHER OFFICES IN

CHICAGO, ILL. 30 W. Washington Street

NEWARK 5, N. J. 193 Emmet Street

KOMLINE-SANDERSON

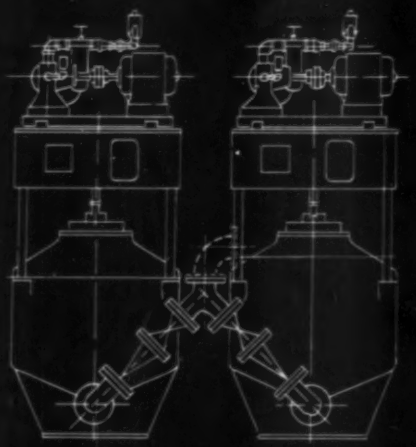
PNEUMATIC SEWAGE EJECTORS

- RUGGED
- DEPENDABLE
- ECONOMICAL

A K-S pneumatic sewage ejector system offers trouble-free service at the absolute minimum of maintenance and power costs.

Available in sizes from 30 to 600 GPM capacities, in single or duplex units. Cast iron or steel construction. Pneumatic or electrode controlled.

Write for new Catalog No. KSM-2



MECHANICAL EQUIPMENT DIVISION

KOMLINE-SANDERSON ENGINEERING CORP.

102 Holland Ave., Peapack, New Jersey

Dorr-Oliver Transfers Wicklund

Dorr-Oliver, Inc., has announced the transfer of Glen W. Wicklund, Central Sanitary Sales Engineer to the Western Division as Manager of the Los Angeles, California, office. Former Manager of Central Division's St. Paul, Minnesota, office, he replaces H. Harvey Hunt who recently resigned.

Mr. Wicklund joined Dorr-Oliver in 1951 as Sanitary Sales Engineer and assumed management of the St. Paul office in 1953. From 1940 until 1943 he had been a laboratory technician with Minnesota Mining and Mfg. Co. He served the following two years as an officer and pilot with the U. S. Air Force. He received a B.S. degree in chemical engineering in 1949 from the University of Minnesota and had been as assistant public health engineer with the Minnesota Department of Health for the years prior to joining Dorr-Oliver.

Mr. Wicklund is a member of the American Water Works Association, Federation of Industrial and Sewage Wastes Association and a member of the Minnesota Society of Professional Engineers.

Barrett Promotes Mitchell and Labaugh

Barrett Div., Allied Chemical & Dye Corp., New York, N. Y., has announced the promotion of D. A. Mitchell and W. D. Labaugh to District Managers of Industrial Tar Products Sales. Mr. Mitchell will cover the Western part of the country, with offices in New York City.

Mr. Mitchell entered Barrett's employ in 1940 as sales representative for its Building Products department in the Birmingham, Alabama district. He was transferred to Creosote & Pitch Sales in 1944, operating out of the St. Louis office, and, in 1956, was made Assistant Sales Manager.

Mr. Labaugh was first employed by Barrett in 1928, in what was then known as the Sales Agency department. He subsequently served Barrett in Administration, Priorities and Purchasing Departments following which, in 1945, he joined the Creosote & Pitch department. He served as salesman and was Assistant Sales Manager at the time of his recent promotion.

New Bulletins

CONTINUED FROM PAGE 27A

Pressure Regulators

623

Kieley & Mueller, Inc., Middletown, N. Y., has released a new 28-page bulletin, "Pressure Regulators and How to Select Them."

Of special interest is a ten-page prefatory section which explicitly spells out the most important considerations for correct applications of self-operating and pilot type pressure regulators. Included are a number of graphic tables that permit the reader to make rapid comparisons of basic regulator characteristics without reference to detailed specifications given elsewhere in the booklet.

The bulletin covers back-pressure and relief valves of spring-loaded and weight-loaded types; reducing valves; remote pilot-type and valve-mounted regulators; pump governors; steam-operated, packless, self-contained and differential regulators. Catalog information has been carefully organized for each item; a consistent format for specification data simplifies selection.

Corrosion Inhibitor

624

Calgon Co., Pittsburgh, Pa., has published a bulletin on Composition TG, a sodium-zinc, hexametaphosphate corrosion inhibitor for municipal and industrial water systems.

Authored by Calgon chemical engineers, the bulletin points out that composition TG is superior to regular sodium hexametaphosphate in controlling corrosion in water mains and cooling equipment. It is said to provide a faster forming, more protective film on metal surfaces, and to be more effective at lower concentrations.

The brochure contains comparative graphs showing flow coefficients ("C" values), rate of film formation as determined by weight loss and current flow, and schematic drawings depicting methods of feeding TG to a system.

Special attention is devoted to mechanical cleaning of water mains where protective phosphate films must form quickly on freshly exposed metal surfaces to maintain high flow coefficients. The text explains that composition TG, because of its zinc base, lays down a protective coating much faster than ordinary phosphate inhibitors.

Area Meter Transmitter

625

Bailey Meter Company, Cleveland, Ohio, has just published a 4-page Product Specification folder on the application of Bailey Area Meter Pneumatic Transmitter to flow measurement of water, gasoline, oil, tar, chemicals, and distillates.

Table of flow ranges is provided along with operating characteristics and installation requirements.

Underground Pumping Stations

626

Zimmer & Francescon, Moline, Ill., has released an eight-page bulletin describing the completely prefabricated Z-F Underground Pump.

Engineers and contractors on subdivisions, industrial sites and other projects, where extensions to sewer systems require that the flow be raised to the level of existing mains, will be interested in the automatic operating features and simple installation requirements of the Z-F Stations, as presented in the bulletin.

Armored Rotameters

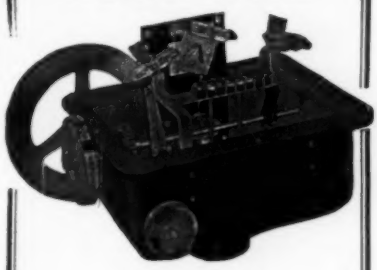
627

Brooks Rotameter Co., Lansdale, Pa., has just released a new bulletin that describes armored Ar-Met rotameters designed for pressures up to 5000 psi and for flow rate equivalents up to 3000 GPM of water. Precision pressure-formed metering tubes dimensionally reproducible to the same high degree of accuracy as glass metering tubes are now used in the new Ar-Met meters.

The Bulletin provides detailed constructural information, dimensions, and capacities. A guide to the selection of transmitting as well as point-of-measurement extensions for Ar-Met rotameters is included in the literature.

CONTINUED ON PAGE 106A

ROTO-TROL



RF-2

WITH ALTO-TROL

This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles.

The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

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Helpful Bulletins *Available Free*

Thermometers

628

Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., has released a catalog that describes the complete line of Brown rectangular case filled system thermometers. These indicators, recorders, transmitters, and electric or pneumatic control instruments are covered in detail in the new 56 page catalog.

Flow Meter Engineering Data

629

The Bristol Co., Waterbury, Conn., has just published a new bulletin of engineering data on differential pressure type flow meters.

Mechanical Draft Fan

630

Chicago Blower Corp., Chicago, Ill., has announced a new four-page bulletin describing Chicago's forward curve mechanical draft fans for central power stations and general industrial service.

TrenchLiner

631

Parson Co., Newton, Iowa, is now distributing a four-page color bulletin on the recently introduced model 170 "Trenchliner." A wheel-type trencher, the 170 digs 5 ft.-9 in. deep, 20 to 32 in. wide.

Weather-Explosion-Proof Housings

632

The Adalet Mfg. Co., Cleveland, Ohio, has combined into a sixteen page bulletin selection and specification data for their extensive line of cast aluminum weather-proof and explosion-proof housings.

Nooter Field Construction Dept.

633

Nooter Corp., St. Louis, Mo., has published a colorful new brochure that describes, by example, the Field Construction Department of the company.

Variable Speed Drives

634

Sterling Electric Motors, Inc., Los Angeles, Calif., has announced the publication of a 8 page colored brochure describing the complete Sterling line of variable speed drives.

Glassed Centrifugal Pumps

635

Goulds Pumps, Inc., Seneca Falls, N. Y. and The Pfaudler Co., Div. of Pfaudler Permutit Inc., Rochester, N. Y., have jointly issued a new 16-page "Facts" booklet on the glassed centrifugal pumps.

Testing V-Belts

636

Goodyear Tire and Rubber Co., Akron, Ohio, has just released a 16-page, informative booklet entitled, "V-belts, the Testing, Inspection and Control of their Quality."

Sewage Primer

637

Yeomans Bros. Co., Melrose Park, Ill., is offering a 40-page primer on sewage pumping and treatment to architects and engineers for distribution to builders and others interested in community facilities.

Sewage Plant Odor Control

638

Rhodia, Inc., New York, N. Y., has just published an attractive 2 color guide for the application of Alamask Odor Control Chemicals which have been specifically designed for use in Municipal Sewage Plants.

Automation of Chemical Feeders

639

Omega Machine Co., division of B-I-F Industries, Inc., of Providence, R. I., has just published a bulletin presenting a number of methods of automatically controlling the concentration of chemical additives that are in current use in industrial and municipal installations.

3-Way Diaphragm Control Valves

640

Minneapolis-Honeywell Regulator Company, Valve Division, Fort Washington, Pa., has just released a new 4-page Specification that gives full details of construction on Honeywell Series 800, 3-way Control Valves.

Diesel Engine Selection

641

Detroit Diesel Engine Div., General Motors, Detroit, Mich., has just released a 16-page booklet outlining what diesel engine users should know and look for when selecting engine fuel.

Shafted Mounted Drive

642

Falk Corp., Milwaukee, Wis., has just released a new 32-page illustrated bulletin that describes the complete line of Falk all-steel helical gear, Shaft Mounted Drives for applications in the range from ½ to 50 hp and from 420 to 5 rpm output speed.

Controlled Speed Systems

643

U. S. Electrical Motors, Inc., Los Angeles, Calif., has published a new illustrated booklet, "Controlled Speed Systems," which describes many typical installations for controlled automatic variable speed systems application.

Digester Supernatant Corrector

644

Yeomans Bros. Co., Melrose Park, Ill., has available preliminary engineering data on a new method and apparatus for high pressure aero-oxidation of digester supernatant—the Presaire (R) Supernatant Corrector.

Proportioning Pumps

645

Hill-McCanna, Chicago, Ill., has just released a new two-color, eight-page catalog featuring Hills-McCanna Precision Proportioning Pumps.

Zeolite Softeners

646

The General Filter Company, Ames, Iowa, has just published a new Zeolite Softener bulletin. It is a twelve-page publication, well illustrated and contains useful information for engineers and operators of water treating equipment. Several useful tables and charts are included.

Filter Operating Control Desk

647

Bailey Meter Co., Cleveland, Ohio, has published a new 2 page brochure that describes and illustrates three desk type control panels used in water treatment plants for operation of rapid sand filters.

Venturi Meter Tubes

648

Builders-Providence, Inc., division of B-I-F Industries, Inc., Providence, R. I., has available a comprehensive technical bulletin describing the various types of Venturi Tubes, their recovery characteristics, the formulae that determine their design, typical calculations, and similar data.

Metering and Control Sytsems

649

Bailey Meter Co., Cleveland, Ohio, has published a new 4-page bulletin describing the purpose, design, and operation of Bailey Metering and Control Systems.

O-R-P Recording

650

Fischer & Porter Co., Hatboro, Pa., has available a catalog that describes O-R-P Cell and Potentiometer-Type Recorder for measuring, indicating and recording oxidation-reduction potential.

"For tight spots and tough roots... nothing beats our Buckeye 403's!"

— says J. W. Cain, Sarnia, Ontario

Seventy-eight miles of service line and connections will soon bring natural gas to hundreds of thousands of Ontario residents. Handling the ditching is Contractor J. W. "Jim" Cain, a newcomer to Canada's booming pipeline industry.

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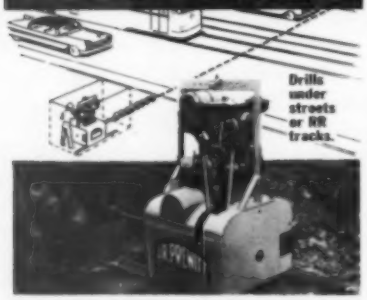

DRILLS 2½ " to 20" DIAMETER — 50' to 100' LONG—Cut labor, overhead and maintenance cost with the amazing new Prewitt Horizontal Auger Drill. Requires ground opening of only 4' x 10'—easily operated by one man. Light weight unit can be lowered in operating position by back hoe. Unit is self contained . . . requires no air compressor, generator, or water. Eight auger sizes are available from 2½" to 20" in diameter. Drills holes from 50' to 100' long . . . holds straight line. Easily reversed for retracting augers.

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Pleasant Hill, Mo. Dept. 502 Phone 40

New Bulletins

CONTINUED FROM PAGE 103A

Two-Column Gas Chromatography

651

Beckman Scientific Instruments Div., Fullerton, Calif., has just published a 4-page Data Sheet that describes and illustrates the time-saving benefits of two-column gas chromatography.

Application information features uses and advantages of two-column operation with Beckman gas chromatographs.

Steel-Plastic Pipe

652

Jones & Laughlin Steel Corp., Pittsburgh, Pa., has just released a four-page pamphlet containing information about a newly-developed rigid plastic pipe encased in a steel jacket.

According to the pamphlet, the new product combines the pressure-retaining strength of steel pipe with the chemical resisting qualities of unplasticized polyvinyl chloride pipe.

The pamphlet contains specifications, line drawings and other pertinent information.

Trenchliner Versatility

653

Parsons Co., Newton, Iowa, has just published a 12-page catalog emphasizing the versatility and ruggedness of the Parsons 310 Trenchliner.

Included among 48 illustrations in the 2-color catalog are detailed assembly pictures showing how even weight distribution and 3-point suspension allow the 310 to maintain uniform ground pressure.

Two full pages of the catalog explain the variable speeds that can be used for all types of operations, and how the reversible power shift spoil conveyor and offset digging telescopic boom permits the 310 to cut within 14 in. of obstructions.

Meter—Pump

654

Hills-McCanna Company, Chicago, Ill., has released a new eight-page, two-color bulletin featuring the new integral McCannameter, a proportioning pump.

The bulletin describes in detail the features of this new design that affords space savings of up to ⅔ over previous designs. The McCannameter is available in either diaphragm or bellows construction with capacilities from 6 cc/min to 6 gph. Maximum discharge pressure is 2500 psi. Dimensional specifications are also shown.

Demineralization

655

Graver Water Conditioning Co., New York, N. Y., has just announced the availability of a newly revised and enlarged bulletin, on Demineralization.

In addition to several basic sections on the application of demineralizers, their basic principles of operation and the chemistry of the ion exchange resins, this bulletin includes detailed information and charts on materials of

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construction and the design of component parts.

It includes comprehensive comparison charts on Multi-bed, Mixed-bed and Scavenger or Polishing demineralizers which indicate the design of the system, its application and advantage over other systems and the results that can be expected. Detailed layouts of each type of system and operating cycle drawings round out this section.

Other sections are devoted to automatic control, regenerating systems, chemical handling and conductivity measurement. Of particular interest will be the section on estimating operating costs for various types of systems and the tables of useful data.

Cylinder Actuators

656

Conoflow Corp., Philadelphia, Pa., has recently issued a 12-page booklet describing the company's complete line of Series 50 Cylinder Conomotor actuators.

The bulletin describes the operation and versatility of the Cylinder Conomotor, listing its numerous applications, including proportional control of different types of valves, speedchangers, pumps, rheostats, autotransformers, flow regulators, etc. More than 20 applications are illustrated.

How to Lay Concrete Pressure Pipe

657

Price Brothers Company, Dayton, Ohio, has just issued a new and revised edition of the manual "Concrete Pressure Pipe Laying Instructions."

The 16-page booklet boils technical data down to practical application. Large on-the-job photos with brief explanations clearly illustrate the step-by-step procedure in concrete pipe-laying installation. Also provided are up-to-date tables of pipe sizes and deflection data.

Valuable for use on the job, the pocket size manual tells how to dig the trench and handle the pipe, gives easy steps in making the joint, and describes pipe bedding procedure. Complete instructions include a check list of supplies and equipment needed for the job.

For Important Information
on Products and Services
see the 1957-1958
WATER & SEWAGE WORKS
REFERENCE and DATA NUMBER

The following firms have information of interest to you in the 1957-58 REFERENCE and DATA NUMBER

Airkem, Inc.
Alabama Pipe Co.
Allis-Chalmers
Amercoat Corp.
American Vitrified Prod. Co.
American Well Works
Anthracite Equipment Co.

Bailey Meter Co.
Beaumont Birch Co.
Bethlehem Steel Co.
B-I-F Industries, Inc.
Borden Metal Products Co.
Builders-Providence Inc.
Byron Jackson Pumps, Inc.

Chain Belt Co.
Chicago Bridge & Iron Co.
Chicago Pump Co.
Clarksville Foundry & Machine Works
Jas. B. Clow & Sons (Iowa)
R. D. Cole Mfg. Co.
Columbia Southern Chem. Co.
Combustion Engineering, Inc.
Cook Well Strainer Co.

Dorr-Oliver, Inc.

Fischer & Porter Co.
Foster Eninecring Co.

General Chem. Div.
Allied Chem. & Dye Corp.
General Filter Co.
Golden-Anderson Specialty Valve Co.
Graver Tank & Mfg. Co.
Graver Water Conditioning Co., Inc.

Hardinge Co., Inc.

Infilco, Inc.
Ingalls Iron Works Co.
International Minerals & Chemical Corp.
Iowa Valve Co.

Jeffrey Mfg. Co.
Johns-Manville
John Wiley Jones Co.

Komline-Sanderson Engineering Corp.

Link-Belt Co.
Ludlow-Rensselaer Valve Mfg. Co.

M & H Valve & Fittings Co.
Millipore Filter Corp.
Morse Boulger Destructor Co.
Multiplex Mfg. Co.

Natco Corp.
National Clay Pipe Mfrs., Inc.
National Power Rodding Corp.
Neptune Meter Co.
Nichols Engineering & Research Corp.

Olin-Mathieson Chemical Co.
Omega Machine Co.

Pacific Flush Tank Co.
Pennsalt Chemical Corp. (Western Div.)
Permutit Co.
Phipps & Bird, Inc.
Henry Pratt Co.
Presstite-Keystone Engineering Products Co.
Pressure Concrete Co.
Proportioneers, Inc.

Rensselaer Valve Co.
Roberts Filter Mfg. Co.

Schramm, Inc.
Simplex Valve & Meter Co.
Smith & Loveless, Inc.
S. Morgan Smith Co.
A. P. Smith Mfg. Co., Inc.

Tennessee Corp.

U. S. Pipe & Foundry Co.

Walker Process Equipment, Inc.
Wallace & Tiernan, Inc.
Washington Aluminum Co.
Water Seals, Inc.
Western Machinery Co.
White Diesel Engine Div.
Worthington Corp.

Yeomans Bros. Co.

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Sump and Process Pumps

658

Goulds Pumps, Inc., Seneca Falls, N. Y., has just published a bulletin describing its line of heavy duty vertical centrifugal pump and process pumps. Single and duplex units, as well as wet and dry pit types, are covered. Units are available for pit depths up to 20 feet with capacities to 1080 gpm and heads to 290′.

Bulletin includes specifications, sectional views, performance ratings, and a chart of materials of construction for interchangeability.

Wet and Dry Feeders

659

Denver Equipment Co., Denver, Colo., has just published a four-page bulletin showing their Model 12-A Denver Wet Reagent Feeders and Cone Type Dry Feeders. According to the bulletin, the wet feeder provides continuous operation, light weight and laboratory accuracy with feeding rate up to 2250 c.c. per minute. A stainless float valve permits use of quantity storage of reagents in other locations. As many as 10 cups attached to a revolving disc dip into the reservoir and empty to create a stream. The slow speed pouring prevents cascading and increases accuracy. Extreme accuracy in measuring feed rate is accomplished by moving the feed trough into the stream.

The Denver Cone-Type Dry Feeder is described as having three simple adjustments to give accurate feed control: (1) Speed, (2) Depth of bed, (3) Amount of discharge cut. Dry reagents fall on revolving disc where adjustable collar regulate depth of material. An adjustable scraper then removes a uniform portion of the chemical as the disc revolves. A vibrator to prevent packing of chemicals in the cylinder of cone is included with the 36″ feeder and is optional on the smaller sizes.

Cold-Applied Anti-Corrosive Coating

660

Selby, Battersby and Co., Philadelphia, Pa., has developed a cold-applied anti-corrosive coating for steel surfaces.

Known as Komul, this anti-Corrosive agent is an irreversible uniform emulsion of coal-tar pitch stabilized with mineral colloids, and ready for application without heating. It provides the excellent corrosive-preventing qualities of coal-tar pitch without the disadvantages, because it is easy to apply and has good resistance to the effects of temperature change. It contains no bentonite clay, soluble soap, asphalt, sulphite pitch or sulphonic acids.

In cured form, Komul adheres firmly in a smooth, tough continuous film which is highly durable. There is no flow at high temperatures or brittleness at low temperatures. Komul dries from the inside out by evaporation of the water vehicle through the water film, producing a flexible, dark grey, non-tacky impermeable barrier.

Freezing has no effect on the cured film which also does not burn, but chars at 800°F. Because it is non-volatile, it gives off no toxic fumes and there is no hazard during application. Komul-coated surfaces can be burned through by torch or stud-welded without fear of fire. Film is unaffected by most petroleum derivatives, commercial inorganic salts and acids. It is not affected by the heating rays of the sun, and is impervious to water.

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NOTICE TO BIDDERS

USED DISPOSAL PLANT EQUIPMENT

The Joint Meeting of the City of Plainfield, Borough of North Plainfield, and Borough of Dunellen, having joined an area Sewerage Authority, is discontinuing operation of its Sewage Disposal Plant. Used equipment including chlorinators, hot water boilers, pumps and motors, heating units, heat exchanger, and miscellaneous sewage treatment plant equipment is available for sale. Sealed bids will be received, publicly opened and read, at the City Hall, Plainfield, New Jersey, on June 24, 1958, at 8:00 P.M., D.S.T. Interested bidders should contact Andrew Palmer, Superintendent, P. O. Box 11, Dunellen, New Jersey, for list of items and other details of sale, including proposal sheet and arrangements for prior inspection.

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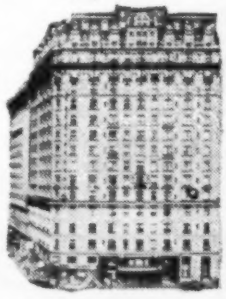

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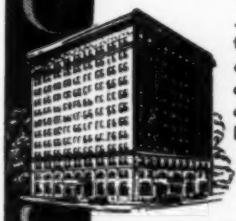

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